ACTA UNIVERSITATIS SZEGEDIENSIS

ACTA BIOLOGICA

NOVA SERIES

TOMUS XVI FASCICULI 1–2

SZEGED (HUNGARIA)

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Adiuvantibus

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redigit

ISTVÁN SZALAI

editionem curant

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Edit

Facultas Scientiarum Naturalium Universitatis Szegediensis
de Attila József nominatae

Nota
Acta Biol. Szeged

Szerkeszti

SZALAI ISTVÁN

A szerkesztőbizottság tagjai

FEHÉR O., HORVÁTH I., LIPTÁK P., MÓCZÁR, L.

Szerkesztőbizottsági titkárok

BODROGKÖZY GY., HORVÁTH A.

Kiadja

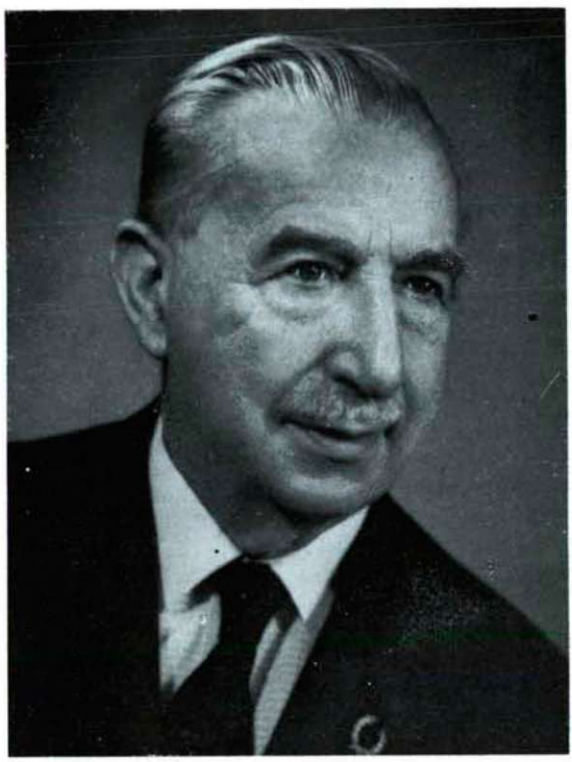
A Szegedi József Attila Tudományegyetem Természettudományi
Kara (Szeged, Aradi Vértanúk tere 1)

Kiadványunk rövidítése
Acta Biol. Szeged

68-5764 Szegedi Nyomda

WE ARE PUBLISHING THIS VOLUME
AS AN HOMAGE FOR PROF. DR. P. GREGUSS

Acta Biologica Szeged 16 (1—2), pp. 5—10 (1970)



PROF. DR. PÁL GREGUSS IS EIGHTY YEARS

It is a general opinion that a man reaches the maximum of his ability at about the age of forty. Then the productivity persists for a longer or shorter time but decline is, unfortunately, a biological law.

Professor GREGUSS' s career is considerably differring from that. He made his mark as a scientist even in his youth. We should think, for instance, on the laying the foundation of his triphyletic theory of development in 1917, *i. e.* more than fifty years ago; and the peak of his activity falls beyond the fiftieth year of his life. In that time he found in the domain of xylotomy the field of research that has corresponded

the most to his individuality, his good observing power, excellent memory, technical ability, great working capacity and diligence. By studying and cultivating that field of science he has become a botanist known and recognized on a world scale.

In 1947, that is to say in his 58th year of life was published his first great work in in this field, treating of the comparative histology of the trees and shrubs in Central Europe. His monograph about xylotomy of the *Conifers* living today was published by the Publishing House of the Hungarian Academy of Sciences in his 66th year of age. In 1959, 1967, and 1969 were published the other volumes of that series in which he was dealing partly with the xylotomy of *Cycas*, partly with the comparative and monographic elaboration of plant fossils. He was close to eighty as the manuscrips of volume 6 of this xylotomic series dealing with the living and fossil arborescent plants was finished and given to the Publishing House of the Academy of Sciencet for being published. It is there in preparation at present.

This monumental work, unparallelled even on a world scale, has not only required the preparation and careful analysis of many thousand dissections but is was very difficult to get the material, as well. Every obstacle was, however, surmounted by the devotion to science that has always been characteristic of Professor GREGUSS who is, even at the age of eighty still in the full vigour of his spiritual and physical powers.

Professor GREGUSS was born in Tornya (31. December 1889) int the county Csanád. As a son of a simple village joiner, he aerly got in touch with nature. This vicinity of nature may have had a role in making him love the "scientia amabilis". He was educated in a grammar school a teachers training-school and college, in Arad and the University in Budapest. After graduating he has functioned in every form of education from primary or grade schools up to the chair of University. His masters were JÁNOS WAGNER, resp. GUSZTÁV MOESZ in the teachers training school, resp. college. Apart from the influence of the renowned botanists, there cannot be neglected the time, eigher, he spent in Prague with the world-famed botanist, Professor PASCHER.

His educational activity began at a teachers' training-school in Csáktornya, later he got to the Teachers' Training College in Budapest. He obtained his doctor's degree in the time of the Hungarian Soviet Republic (1919), later becoming assistant first at the Training College of the higher elementary school teachers and then at the University in Budapest. After the initial difficulties, his way of life was from that time on in the ascendant. In 1927 he was commissioned to organize and head the Botanical Institute of the University in Debrecen and in 1928 he became professor and head of the Botanical Institute at the Training College of the Higher Elementary School Teachers in Szeged. There he taught and educated till 1940, then he was appointed the Head of the Botanical Institute and Director of the Botanical Gardens of our University. He conducted the Institute and the Botanical Gardens for 25 years till retiring as professor emeritus in the age of 76. His retiring does, however, not mean any break in his creative work; since then, too, he has got on with working, creating and educating according to his earlien rhythm of life

Professor GREGUSS served for 102 semesters the higher education. Being retired, he is still going on with delivering special lectures at the University. During his functioning as professor for more than half a century — and he is with reason proud of that — he never omitted even a single lecture through a fault of his, showing by that not only his conscientiousness and healthy organism but also his respect for the instructive and educational work and the affection for youth.

His instructive-educational activity is of a great many aspects. A great number of educational papers and handbooks have propagated the biological instruction on the basis of experiments and of observing the living matter. The idea of the so-called school of work in the biological instruction was created by his activity in this country. This method of lecturing on the basis of the students' activity was introduced by him into the higher education, as well, and his book about 400 simple plant-physiological experiments was written for promoting that purpose.

In writing and action, he has contributed considerably to popularizing biology. He wrote his book about The wonderful life of plants, delivering several popularizing lectures in extramural courses, factories, youth communities. And his college and university lecture notes have ensured for the students the possibility of preparing more perfectly. He has always prepared conscientiously for his lectures, explaining his topics clearly, with impassioned eloquence, with a heat of love for his subject-matter. The living plants have never been missing from his teacher's desk, as well as the visual figures from the wall of his lecture-room, and the expressive, exact and simple but also aesthetically nice explanatory drawings from the blackboard.

It has often been said that teaching is a thankless task as the invested energy is often not in proportion with the result. There is proved just the very opposite by the instructive-educational activity of Professor GREGUSS. He may be proud of a very great number of students having worked very efficiently. He is often seen by his thankful students, even by those having visited his lectures fifty years ago. The results of GREGUSS's school are proved, among others, by the four Academic Doctors of biological sciences, more than ten candidates, several University Doctors of science, as well as a great number of University and college professors, lectures or investigators.

Professor GREGUSS's organisational work is worth mentioning, as well. Here we have to emphasize mainly the Botanical Gardens of the University in Szeged that, after Liberation, had to be re-created, starting nearly with nothing, as a result of the ravages of war. His organizing activity and unselfich generosity meaning often even material support were necessary for rising the Botanical Gardens in Szeged on a Europen level serving both scientific education and the general propagation of popular science on a high level. Coming to the scientific results of Professor GREGUSS, we should like to emphasize first of all that his scientific activity had begun in his very youth. Ha was learning in a middle school as his written reports about his botanical collecting journeys were published in papers for the young, school reports. He was early interested in the theories of evolution, in DARWIN's doctrines. By studying the problems of the theory of evolution, the young PÁL GREGUSS was led in two directions. One of the directions was genetics in which he has got new results mainly as to the research of sex inheritance. This activity of his came to a conclusion as early as in 1935, by writing his book Introduction to genetics that was the first original work of that character in Hungary.

The other direction conducted him to the investigation of the evolutionary history of flora. As mentioned above, he wrote, still in 1917, his monograph about the polyphyletic development of flora. Then a systematic research work followed for several decades as a result of which in 1955 he treated of the phylogeny of *Gymnosperms* already in the spirit of his so-called triphyletic system. In 1965, he explains in an original publication his theory concerning the triphyletic development of the land-flora.

The idea of polyphyletic phylogenesis is not new in phylogenetics. Professor GREGUSS's great merit is to have synthetized these detail theories into a homogeneous triphyletic theory. The fundamental idea of his theory is the conservatism of branching conditions, concretely that of the monopodial, dichotomic, and verticillate branchings that can be found in every evolutionary level from mosses till *Angiospermae*. The three parallelly developed lines of the vegetable kingdom that hasn't any collateral connections are formed by taxons of different development but identical branching.

The triphylectic theory of Professor GREGUSS was taken with enthusiasm by many investigaters. Like any original idea, however, this had some antagonists, as well. But that opposition has, of course, not discouraged Professor GREGUSS, and this genuine scientist does not omit any opportunity, even to-day, to discuss the results of his morphological, histological, palaeobotanical investigations from the point of view of his triphyletic theory.

The most extensive part of his activity that was received favourably by all falls in the domain of xylotomy. Inside that the most complete part is the histological elaboration of the early and late wood of the living *Gymnosperms*. PÁL GREGUSS even after 50 years of age had enough energy for the enormous organizing activity with which he could lay up a supply of material needed for his investigation from every part of the world, mostly from their original habitat. The collection of high value, unparallelled the world over, a proper pride of Professor GREGUSS, is composeg — apart from the six bulky books — besides the *Gymnosperms* of the trunk-remains of every European deciduous tree and shrub and of several others originating from other continents and of the sections prepared of those. In 1970, he finished his work "Identification of living *Gymnosperms* on the basis of their xylotomy", published in English language, completing in that way the xylotomy of nearly all the conifers living on the Earth at present (505), presenting the palaeontologists an indispensable Manual for determining their plant fossils.

In the meantime, he has written several popular and scientific monographs, university lectures, etc. The number of his papers, buplished in print or mimeographed, is approximating 300, about 30 of them being original scientific books and monographs 35 text-books for various types of middle-schools, compendia for university lectures, resp. university and college lecture notes.

This scientific and educational activity of so many aspects has obtained respect and recognition from the national administration, as well. After Liberation, he was elected as honorary member by the Society of Natural Sciences. In 1955 and 1959, and on the third occasion in 1965, he was honoured by our Government with the Gold Medal of the Order of Labour, and in 1958 with the silver degree of the KOSSTHU prize. From 1947 till 1950, he was Dean for one year and ex-Dean for two years of the Faculty of Natural Sciences of the University in Szeged, and in the academic year 1957/1958 he functioned as Rector of the University. In 1954, he was honoured by the French Botanical Society with a commemorative medal on the occasion of its centenary. In 1956, ha was qualified Academic Doctor of biological sciences. He was honoured with golden diplomas, in 1960 as qualified school-teacher and in 1965 as certified teacher for the upper forms of schools by the Teachers' Training College, in 1966 as a teacher qualified for the middle-school education by the University Loránd Eötvös in Budapest and as qualified sport teacher by the Training College for Sports-Masters. He was elected as honorary member by the Palaeontological Society of India in December of 1964, by the Hungarian Biological Society, the Botanical Society, and by the Social and General Educational Society in 1970.

By the University in Szeged de was honoured with the commemorative medal Attila József. Meanwhile, he has been invited by the Polish Academy of Sciences, as well as by the Universities in Greifswald, Münster, Rostock, Kolozsvár, Bucuresti, Sofia, Lucknow, Bombay, Delhi in India, by the Teachers' Training College in Postdam, and by the International Botanical Congresses in Paris, Montreal, Edinburgh, Seattle to deliver addresses and lectures, and to be the Chairman of a Section. All these were performed. For acknowledging his scientific activity, he was elected as member by the International Dendrological Society, the International Taxonomical Society, the International Plaeontological Society, the International Society of Wood-Anatomists, the International Plant morphological Society, the German Botanical Society. Even at present, he is keeping up very extensive scientific connections with sciehtists, nearly 600 invetigators and research ers in the most various countries of the world. Several living and fossil plants have been nominated by scientists at home and abroad, paying homage to him.

In addition to Professor GREGUSS's scientific activity, it is to be taken into consideration, too, that during his educational functioning lasting almost five decades long, he organized the Botanical Institute of the University in Szeged, for a quarter of a century he reconstructed the Botanical Gardens of the University in Szeged, developing, it to have a world-wide renown. And in the meantime, he educated hundreds of the teachers of biology, among them 5 college and 6 University professors, foreign scientific researchers, postgraduate students doing research work for a higher degree, senior lecturers, etc., who will remember his scientific and educational endeavours, teaching in elementary schools, various kinds of middle schools, modern technical schools or getting on with their scientific research work in scientific institutions abroad, as well.

He had study-tours in almost all the Eastern and Western countries of Europe. Outside Europe he was in Egypt, Tunisia, Algeria, Morocco, Canada, India, the Caucasus, partly teaching, partly obtaining rich scientific experiences everywhere for his scientific and educational work. His scientific papers and monographs have been published, apart from Hungarian editions, in the periodicals of several countries, too, thus in the Soviet Union, the German Democratic Republic, the German Federal Republic, Belgium, France, Poland, United Kingdom, Canada, and Bulgaria. His works have been discussed in details, sometimes on many pages, in every country of Europe, and even in America, Asia, Africa, and Australia.

Paying homage in the Acta Biologica Szegediensis, as well, to PÁL GREGUSS, getting on with his creative work even as octogenarian, we wish him good health and mental alertness for being able to work among us still for long years, realizing all his several plans that have animated him to do his valuable creative work.

...

In December of 1969, the Botanical Institute of the Attila József University, Szeged, displayed the scientific and educational activity of Professor DR. PÁL GREGUSS in an exhibition arranged in honour of his eightieth birthday.

Major original works of Prof. DR. PÁL GREGUSS.

1. Ein Gedanke zur polyphyletischen Entwicklung der Pfalnzenwelt. (Beihefte z. Bot. Centralblatt p. 229—269. Mit Tafeln II. u. II. Dresden, 1918.

2. Állatbiológiai megfigyelések és állatbonctani gyakorlatok (Animalbiological observations and animal-anatomical practices). 52 plates with drawings, p. 64. Budapest.

3. A természet egysége (Unity of Nature). Pp. 1—68. With 19 drawings. Budapest, 1925.
4. Sommerflora des Szebeshelyer—Gebirges, pp. 1—17. Debrecen, 1930.
5. A növények csodálatos élete (The wonderful life of plants), pp. 536. With 428 drawings mostly original. Budapest, 1932.
6. Bevezetés az örökléstanba (Introduction to genetics). Figs. 98, pp. 220. Budapest, 1935.
7. 400 simple experiments in plant physiology. Figs. 263, pp. 146. Szeged, 1936.
8. Az öthalmi mammut lelet pollenanalitikai vizsgálata (Pollenanalytical investigation of the mammoth find at Öthalom). 153 photographs and 163 drawings on 1—8 plates. pp. 1—16. Szeged, 1940.
9. A középeurópai harasztok spórái. 9 táblán 113 rajzzal. Die Sporen der mitteleuropäischen Pteridophyten. I—IX. Tafeln mit 113 Figuren, Budapest, 1941.
10. Bestimmung der mitteleuropäischen Laubhölzer und Sträucher auf xylotomischer Grundlage. Mit 1000 orig. Mikrophotographien und 250 Tafeln mit original Zeichnungen. Sopron, 1947. The identification of Central-European Dicotyledonous Trees and Shrubs Based on Xylotomy, with 1000 microphotos and 250 plates of original drawings. Sopron, 1947.
11. Xylotomischer Bestimmungsschlüssel der *Pinus* Arten. (Botanisches Institut der Univ. collaborator: **I. Varga**) pp. 1—138, fig. 68, 95 photos. Szeged, 1950.
12. Xylotomische Bestimmung der heute lebenden *Gymnospermen*. Mit 1500 Orig. — Mikrophot. und Zeichnungen auf 360 Tafeln, 8 Tab. Budapest 1955.
13. Identification of living *Gymnosperms* on the basis of xylotomy. With 1500 orig. phot. and drawings on 360 pl. Budapest 1955.
14. Holzanatomie der europäischen Laubhölzer und Sträucher. Mit 1257 Orig.-Mikrophot. und Originalzeichnungen auf 307 Taf. 6 Tab. pp. 1—330. Budapest 1959.
15. Определитель древесины голосеменных по микроскопическим признакам (Пер. В. Р. Филина и О. Н. Чистяковой.) Рис. 1—86, стр. 1—157. Москва 1963.
16. A szárazföldi növényvilág három irányú (trifilektikus) fejlődéstörténete. The phylogeny of sexuality and triphyletic evolution of the landplants. — Acta Biol. Szeged 10, 1—51, 1964.
17. Fossil *Gymnosperm*-Woods in Hungary from the Permian to the Pliocene. 136 Pages, 14 maps, 670 orig. microphot. on 87 tabl. Budapest 1967.
18. Xylotomy of the living *Cycads* with a description of their leaves and epidermis. 950 microphot. and 79 drawings on 185 plates 80 fig. Budapest 1968.
19. Tertiary *Angiosperm*-Woods in Hungary. pp. 1—151, 90 tabl. 750 photos. Budapest 1968.
20. Einführung in die Paläoxylotomie; Untersuchungsmethoden der fossilen Hölzer. 18 Tafeln mit 230 Photos. Geologie, Berlin 1968.

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Acta Biologica Szeged 16 (1—2), pp. 11—15 (1970)

IN COMMEMORATION OF SÁNDOR JÁVORKA*

Like most of the younger botanists in Szeged, I was not destined either to be in a close connection with SÁNDOR JÁVORKA and to speak about him now from a close human intimacy. Instead of personal experiences, I am dependent on the experiences of others. Anyway, the rich literary remains of JÁVORKA are, of course, available for me too. I am attempting by means of these to speek about life and work of this great Hungarian botanist of the recent past.

SÁNDOR JÁVORKA is worthy of being commemorated in this festive meeting because even in one of the most turbulent periods of our history, with more than one turn of 180 degrees, he preserved his human dignity, remained faithful to his people and class, and raised the Hungarian botany, floristics and phytogeography to an international level.

He was born on March 12th 1883 in Hegybánya, in county Hont. His father, a village blacksmith, died young, leaving six orphans. SÁNDOR JÁVORKA had to work, teach, coach already as a little student of the grammar school in Selmecbánya, for enabling himself to finish his secondary school studies. In his student's days at the University in Budapest he also had to sustain himself alone.

Botany aroused his interest early. He published his first papers of botanical topics twenty years old. The way of his development was smoothed by his time spent as research student at the Botanical Gardens in Budapest, during the term of 1904/05. Then he was appointed to a job very convenient to his individuality to the Botanical Department of the Natoinal Museum. Here he took his doctor's degree, 23 years old, with his dissertation entitled "Hungarian species of Onosma" The Museum was an ideal working place for JÁVORKA. He could make long collecting journeys, prepare collections, compare and systematize. The huge collected material of the Museum and nearly the whole necessary literature were available for him. Besides these facilities he had excellent systematizing eyes, a capacity of analysing and synthetizing, and an extraordinary diligence. Until 1919 he published more than 50 papers, spent 530 days in the field, collected and pressed 2600 plants.

A date of his public role and scientific life known also by a larger public was the year 1919. The productive scientist of international reputation, coming from a working-class family was then appointed by the People's Commissariat of Education of the Hungarian Soviet Republic to Director-Curator of the Botanical Department of the Hungarian National Museum.

* Delivered at the 50th anniversary of the Hungarian Soviet Rebublic, in the festive meeting arranged by the Biological Special Commision of the University Attila József and the Department of the Hungarian Biological Society in Szeged on March 27th 1969.

After the Soviet Republic being supressed, he worked retired mostly from public life, summarizing his own work of 20 years and that of his predecessors of 150 years in his principal work published in 1924—25. this work of his and the other ones acquired him world-reputation. In 1934 he was appointed Director of the Botanical Collection. In this sphere we worked until having retired in 1940. In the meantime he became in 1936 an associate and in 1943 an ordinary member of the Hungarian Academy of Sciences.

For us in Szeged, a remarkable date of JÁVORKA's life is 1939 when he was honoured by the University of Szeged with the title of a University professor.

After Liberation he had a considerable social role by taking part actively in creating the new Academy of Sciences, he was editor-in chief of the Hungarian botanical periodical of highes rank, the Acta Botanica Hungarica, and main organizer of a committee created for writing the culture flora series.

JÁVORKA was the most at home in our social medium. He was a member of several social, scientific and sciencepopularizing organizations, having an active function in TIT (Society of Scientific Popularization) and in the Hungarian Biological Society and was president of the latter from 1933 to 1936 and its honorary member after 1958.

For acknowledging his merits, the People's Republic rewarded him with the KOSSUTH prize in 1952, awarded him for his 70th birthday the fourth degree of the Order of the People's Republic in 1953, and the Labour Red-Flag Order in 1958.

His industrious life, so rich in results, ended on September 28th 1961.

Before discussing his scientific work and results, I am mentioning briefly the most important antecedents and problems he could build upon. He had to go beyond these for promoting the Hungarian floristic researches and preparing the right geobotanical division of the country.

The investigation of the flora in Hungary had at first culminated with Kitaibel at the beinning of the 19th century. KITAIBEL's multifold life, full of diseases was short for investigating entirely the Carpathian Basin but his principal work aroused the interest of the local and foreign nature-researchers of the Carpathian Basin containing many endemisms and, for the Western investigators, it meant also some exotica. As a result of that, in the middle of the 19th century the Carpathian Basin could be considered in bold outlines as floristically explored, the data would have been suitable for creating the first synthetizing work about the flora of the Carpathian Basin.

The Austrian oppression following the freedom-fight 1848/49 was, however, unsuitable for stimulating the Hungarian authors to write such a work demanding a highly concentrated and far-reaching activity.

The first attempt to compile the Hungarian flora is connected with the name of a jurist-official in Vienna, August NEILREICH (1866) but he didn't know Hungary and was too conservative for being able to make his mark as a scientist. His main merit has been to have collected conscientiously the scattered literary data, like a precise official, without which the further investigation would have been impossible.

Another attempt came also from an Austrian, ANTON KERNER who gave in his work entitled "Pflanzenleben der Donauländer" (1863), among others, the first phytogeographic outline of the Carpathian Basin, particularly that of the Hungarian Plain, with extremely bright colours, in an excellent belletristic style. For KERNER the Hungarian Plain meant an exoticum, the Orient and, accordingly, he considered it erroneously, as an area of the Pontian flora kingdom.

A prominent representative and elaborator of the floristics and phytogeographical idea in this country, V. BORBÁS (1844—1905), broke with KERNER's concept and recognized correctly what is particular in the Carpathian Basin. He created the so-called Ancient-Mátra theory in which he derives the heath-vegetation from the slopes of the mountain and not from the Orient. At the same time, however, the species were in his work too mobile, plastically difficult to catch.

JÁVORKA could rely upon L. SIMONKAI (1855—1910), a similarly excellent botanist. His most important merit was, according to GOMBOCZ (1936), to have carried out the "house-cleaning" in the literature of the Transylvanian flora. At the beginning he accepted KERNER's geobotanical ideas but later on he came near to the classification of BORBÁS and with regard to the Carpathians, to that of Pax. His error was to consider the Carpathian Basin in his patriotic enthusiasm as a too isolated geobotanical unit differring from anything else.

In addition we have to mention, among others, JÁVORKA's somewhat older contemporary, a prominent investigator of the Velebit and East-Balkans, Á. DEGEN (1866—1934) whose works and extremely rich private collection laid also the foundations for writing a modern Hungarian flora monograph.

Apart from the floristic and microsystematic works and from the early papers of living authors, these were the most important predecessors and antecedents that JÁVORKA could rely upon, anyway after selecting them very critically. For that, however, JÁVORKA had to have a through knowledge of the flora of the Carpathian Basin.

In the history of the Hungarian botany we speak often of P. KITAIBEL as a scientist collecting in an examplary way, making about 20.200 km mostly on foot under the primitive traffic conditions of the end of the 18th century and the beginning of the 19th century, and as a result of his collecting journeys there are approximately 15.000 herbarium-pages in the Botanical Collection. In case of JÁVORKA it would be meaningless to reckon in kms at the modern traffic conditions. The number of his herbarium-pages in more than 22.000, he spent in the field approximately 2.200 days, more than seven years if calculated in working-days.

The foundations for writing the highly expected Hungarian flora monograph were partly these collecting journeys and his own collection, partly the critical investigation of the extremely rich plant material of the Botanical Collection, including the collections of KITAIBEL, HAYNALD, the palatine family, Á. DEGEN and many others.

The "Hungarian Flora" published in 1925, named simply "Big JÁVORKA" for domestic use, was the great flora work looked forward to by the animating atmosphere of the reform period already 100 years ago. "Although the work was made on the model of a plant identification handbook" — writes E. GOMBOCZ (1936) — "in view of its content it is going far beyond the framework of that. Its author had both the capacity of analysing in details and that of making a comprehensive synthesis. In this way, he could create even in the form of an identification handbook a critical work, clearing the untercain data piled up during the decades, elaborating some difficult genera like *Poa, Festuca, Carex, Quercus, Tilia, Hieracium* in a way that it was acknowledged as exemplary everywhere. In addition, he fulfilled the wish of a century and a half, giving us finally a work showing a true picture of the exceedingly rich Hungarian flora". In "Hungarian Flora" included the first geobotanical classification giving the first clear picture of the Carpathian Basin, being mostly reliable even to-day.

This work is connected with his work: „The Hungarian Flora in Pictures", surnamed generally the "Illustrated JÁVORKA" (1929—1934) that "was born from the synthesis of S. JÁVORKA's scientific and V. CSAPODY's artistic capacities and is one of the most valuable product of the whole European botanical literature from the point of view of the true plant pictures" (GOMBOCZ, 1936).

A flora work can, of course, never be accomplished. JÁVORKA was referring in the foreword to the Hungarian Flora to the compromises, uncertainties, the temporary character of species and their areas he had to reckon with, as the data were missing or contradictory. These have already come to a rest as a result of his later work carried on till his death and that of other florists and geobotanists.

I don't think necessary to give here full details about JÁVORKA's activity completing his Hungarian flora work. I am mentioning only that he described on the basis of his own collection more than 120 new taxons exclusively from the *Angiospermae*. It has been only JÁVORKA's great flora work and his activity before and after the appearance of that work that created a foundation for analysing the flora of the Carpathian Basin and preparing its more and more perfect geobotanical classification.

I would like to emphasize two more aspects of his activity. One of them is the respect for the predecessors and collaborators. JÁVORKA often met in the Botanical Collection excellent early experts of the Hungarian flora, plants collected by them and hall-marked by their names. His Humanity has required of him, apart from the pressed plant species being systematically interesting, to look behind these pages in several senses, looking, among others, for botany and the man serving his country. He publishes a lot of articles about the rose expert A. KMET, the prominent Transylvanian florist J. CSAPÓ the remarkable botanist and Maecenas Archbishop L. HAYNALD, Professor S. MÁGOCSI—DIETZ, Á. DEGEN, R. RAPAICS, J. BERNÁTSKY, the nature-lover L. KOSSUTH, F. HOLLENDONNER and others, so for instance about one of the amateur botanists who played a considerable role in the Hungarian flora investigation, the prominent art historian, K. LYKA.

The most remarkable of his biographical works is that written about P. KITAIBEL. In its introduction we can read: "This paper wants to throw light upon the period in the development of natural sciences as the waking Hungarian research spirit integrated efficiently with the contemporary European progressive movements and began to explore the natural resources of the Hungarian soil." From these words we can gather his scientific credo and desire: the results of the national science have to move on the same level as the international results of science. The first example was given by himself.

The other aspect to be emphasized is his role in the popularization of science. His books entitled Flowering Nature, Flowers of Wood and Meadow, Our Garden Flowers are proving that if somebody knows, he does teach, too. The three description of nature, and even any wide-spread circulation of a material of knowledge means a step forward to a man released from delusions and prejudices. And in this fleld we have still much to do in Hungary. JÁVORKA gave again a good example in this respect.

S. JÁVORKA was known, respected and liked, of course, not only by the whole botanical world in this country. He had a very large circle of friends abroad, too. He was is standing correspondence mainly with his Czechoslovak, Rumanian, Jugoslav, Polish, Austrian, Bulgarian colleagues, too, and was in friendly relation also with Russian and later Soviet botanists. A friend of his was the great Russian-

Soviet botanist Boris Fetchenko and later also the president of the Soviet Academy of Sciences, VLADIMIR KOMAROV. Between the two world wars, when a correspondence with Soviet researchers was dangerous to life, JÁVORKA was not prevented from maintaining the scientific relations by any prejudice in thiz country.

Finally, beyond the scientist, I would like to say one word ot two about the man himself, as well. ZÓLYOMI writes about him (1962): "He was not only outstanding individuality of a period of the history of science but also a true man, a warm-hearted humanist: quiet, modest, contempting appaerances, free from vanity and false glamour, taciturn and charitable. He was fond of his colleagues, had a great regard for any assiduous fellow-creature of good will and evaluated them on the basis of their inner values and work. He felt particularly attracted by youth, supporting their desire for knowledge. If somebody appealed to him for his advice in a special question, he endeavoured with the greatest patience to give him an exact, precise answer. We performed the tasks given him or undertaken conscientiously, exactly, vnd with the greatest persistance. He condemned superficiality and negligence, disapproving them nevertheless only kindheartedly. But he could never support silently any unlawfulness."

One of JÁVORKA's characteristics was his patriotism. His love for his country scene, for the lowlands of the great Hungarian plain, the "puszta", for the Transdanubian downs is apparent in every work of his. This patriotism, however, is sober without the romantic exaggeration of the last century nor participating in the chauvinism of the pre-war period. JÁVORKA has not only the love of the landscape, of the earth creating woods and fields but also that of man, of our people, of our whole culture, as well. He was fond of the creating man who has something to give to his country: a scientific result, an industrial or agricultural product or a political act forming the new country. S. JÁVORKA was placed by his fate and qualities to lake the lead of the researchers of the Hungarian flora. His scientific results have gained him the respect of his contemporaries and of posterity, as well. And his human behaviour ensured him a general respect and affection.

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Acta Biologica Szeged 16 (1—2), pp. 17—19 (1970)

IN MEMORIAM ADOLF LENDL (1862—1943)*

ADOLF LENDL was born in Orczyfalva (then in county Temes), on May 6th 1862. His father was chief medical officer of the county. Educated in Temesvár, in a modern technical school, he was studying at the Polytechnic and the University in Budapest. His talent, diligence and devotion to science soon attracted attention, in spite of his great modesty. In 1886—1887 he was assistant professor at the zoological chair of the University in Budapest. He took his teacher's diploma in 1884, his doctor's degree in 1887, both in the University of Budapest. In 1887 he accompanied the prominent Hungarian ornithologist, OTTO HERMAN to Norway and they studied there the life of the northern bird-mountains. In 1888 he was already privat-docent at the Polytechnic in Budapest. From 1888 to 1890 he was deputy professor in the same institute. In 1890—94 he was under-keeper of the zoological department of the Hungarian National Museum and leader of its taxidermist laboratory. In 1894 he gave up his post and started a taxidermist and school-equipment manufacturing laboratory in Budapest. In Hungary, before ADOLF LENDL nobody had tried to establish an undertaking like that. By starting the laboratory, he wanted first of all to help for the great inadequacy of the means of school demonstration. In that time his personal activity as a taxidermist was particularly strong, without giving up, however, his scientific research work. He took the possession of a great lot of material collected for being mounted, its investigation considerably enriched his zoological knowledge. He has observed, for instance, that the brain of the small very shaggy black Hungarian sheep-dog ("puli") is more developed than that of the other sheep-dogs. In 1901 he was elected a Member of Parliament in the constituency of Temesrékás. The population of his constituency was first of all engaged in growing cabbages and was in severe distress. LENDL taught them to grow wares preserved in a unitary way and satisfying even the demands of wholesale trade and to sell them in proper markets. Owing to his activity, the living standards of people have risen in his constituency in a high degree.

In 1906 ADOLF LENDL headed an expedition to Asia Minor. It was four of them. They have collected mainly on the Anatolian plateau and in the Taurus mountain. As a rule, they walked. They carried the scientific material packed in cases in carts to the railway station and there posted them to Budapest. LENDL has collected not only a huge amount of zoological material but, in addition, he was interested in everything. He has observed equally the life of people, their customs, outlook, personal belongings, the relics of the old Assyrian civilization, and the situation of the European settlers. In 1907 he was collecting in Argentine, at the request of the Museums of La Plata and Buenos Aires. On that ocasion, he walked with a single attendant through the South-American continent, first from East to West

* Lectured in the Hungarian Biological Sociaty at the 25 years existence of Hungarian Republic.

and then back. They were escorted by an Argentinian mounted soldier who rode before with the stock in hand and collected material, waiting for them in the appointed place every evening.

The great walking-tour lasted there and back six months. In the huge amount of its material have participated not only the museums of Argentine but the Hungarian National Museum, as well. LENDL made during the expedition systematically maps and observed also the life of population.

ADOLF LENDL was in the years 1911—1919 the director of the Zoological and Botanic Gardens in Budapest. He has reconstructed the whole institution. Before he had studied personally a lot of European zoological gardens. At reconstruction, he took first of all pattern by HAGENBECK's zoological garden in Hamburg. His zoological garden had a high European level in this time.

He got on with his research work systematically even during his being the director of the Zoological Gardens. His microscope was unparallelled in his time. Putting together two draw-tubes, he could magnify twenty-thousand times. His social activity was always very intensive. In 1916 he wrote, under the title "Hősökfalva" (Village of Heroes) a lengthy publication in the interest of the disabled soldiers of World War. He wants let the disabled persons get land grants. The land would not have been a present nor a tenure but simply given into cultivation by the State. He calculated three"hold" of land (1 "hold" 0.57 hectares) per capita, recommending on that small area a profitable labour (fruit- and vegetable-growing, poultry-farming, bee-keeping, etc.). The plan was elaborated with an exact budget. He demonstrated that its realization would be good not only for the disabled persons but also for society. His paper "Jövőbetekintés" (Prescience) was published in 1917. It contains a detailed townplanning programme of Budapest, thinking on developing the foreign tourist traffic, as well. In 1917 he became an associate of the Hungarian Academy of Sciences. The sponsor of his being an associate was the then professor of zoology in the University of Budapest, LAJOS MÉHELY. The sponsoring writing is enumerating LENDL's papers of zoological topics in 75 lines.

The proletarian dictatorship of 1919 was received by ADOLF LENDL with much pleasure. He expected of it the development of the Zoological Gardens and of the Hungarian National Museum and generally making science public property. His paper entitled "A plan of the new Museum for Natural History and Ethnography" was published in 1919. In that he makes clear that the Museum has to serve not only the direct science but also adult aducation. The great and deep economic reform is followed by a general social transformation. One of the major factors of that is deepening the cultural development. The lower ranks of people are to be raised up to a more civilized stage. His detailed plans describing the Museum to be created are perfect both from professional and from didactic points of view, even if regarded at present. He has demonstrated, too, that the old regime had committed omissions in the field of the development of civilization. His sympathy for the Hungarian Soviet Republic was not forgiven him by the government after the downfall of the Republic. He was dismissed from being the director of the Zoological Gardens and was not re-admitted to the Hungarian Academy of Science, either. In 1929 he retired. In 1932 he drew back also from scientific life and retired to Keszthely. There he still lived for 21 years quietly, retired but not withdrawn into himself. He took long constitutional walks, was interested in everything and endeavoured, all the while, to spread the interest in biology. His inner world remained serene and peaceful till the end. He was a person generally known and beloved in the environ-

ment of his home. In 1934 he wrote a series of articles entitled "Keszthely letters about planned economy" in the periodical "Balatoni Kurir" (Courier of Balaton). In that he explaines that in the vicinity of his home there would be help for the poverty of people if they could utilize the possibilities given by nature. He refers to his experiences in Denmark and Holland. He demonstrates that fowl-houses, pigsties and hothouses could be heated with the water of Héviz canal in Keszthely. In hot-houses flower and vegetable primeurs could be grown. Also breeding of fur animals, wholesale production of quince jelly and prunes of a unitary quality would be profitable. The wares produced would be disposed of by co-operatives.

The number of ADOLF LENDL's papers exceeded 300. He has first of all dealt with morphology, histology, anatomy, ecology and taxonomy of spiders and harvest —spiders. His research work was characterized, in spite of being so comprehensive, by a profound study of details. In his collecting journeys he gathered a zoological material of enormous quantity and scientific value. He attached great importance to popular works and a considerable part of his papers is of educational character. He published, and edited the periodical "Természet" (Nature) for ten years, exerting a rich literary activity for the Zoological Gardens, as well. His educational writings are written in an elevated scientific spirit and with a good didactic sense. Apart from his zoological papers, his writings imparting a new impulse to the economic life are remarkable, too. There reverberate from these: a scientific autlook, unselfish readiness to help, and an excellent common sense.

ADOLF LENDL was great as scientist, as a militant character of public life, and even as a human being. He was an exceptional personality being so unselfish, modest, good-hearted, serene and tranquil in mind. He lived with the smallest possible demand, modestly yet happily. He never asked for, only always gave. His highest aim was during his whole life to raise the cultural and economic level of the Hungarian people. With his progressive spirit, he preceded his age in a great many respects. His memory is kept green by a statue at the gateway of the Zoological Gardens in Budapest, but it ever remains in our hearts, as well.

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Acta Biologica Szeged 16 (1—2), pp. 21—41 (1970)

ECOLOGY OF THE HALOPHILIC VEGETATION OF THE PANNONICUM VI. EFFECT OF THE SOIL-ECOLOGICAL FACTORS ON THE VEGETATION OF THE RESERVE OF LAKE "DONGÉR" AT PUSZTASZER

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(Received April 20, 1970)

Lake "Dongér" at Pusztaszer is a natron lake, lying about 35 km north of Szeged, developed as a consequence of wind and inland-water erosion, with shallow water that periodically becomes dry. Its formation has also been influenced considerably by the inundations of the river Tisza. Since the regularization of river ways its water supply is ensured mainly by the spring inland waters. The overflow is generally drawn through the Dongér-canal.

Shape and size of the lake differred in the past considerably from those to-day. Its arms, bays have changed into salt marshlands owing to the siltation. The siltation of its western part was precipitated by the aeolian sand movement of the Holocene period. The soil-ecological circumstances have consequently rendered possible the production of extremely varied halophilic and glycophilic biocoenoses. Therefore, it proved to be very suitable to perform alkali-investigations of complex character. The team performing a complex investigation of natron lakes in the Hungarian Plain has carried out here systematically zoological, botanical, bioclimatologic and geological investigations since 1965. Owing to the biological values revealed in the course of years it became necessary to declare the lake Dongér and its immediate environs a nature conservation area. After five years, apart from other branches of investigation, the geobotanical—synecological conditions, as well, begin to give a definitive picture. We want to render account now about the results of our investigations in this direction.

Lake Dongér and its environs have looked very promising for improving the synecolocical knowledge of the halophilic vegetation of the Pannonicum — after offering a brief survey of its typical salt phytocoenoses developed in its solonchak and solonetz (BODROGKÖZY, 1962; 1965a; 1965b; 1965c; 1966). This area is namely lying at the eastern border-line of sandy soils originated from the Danube and rearranged in the Holocene and borders immediately on the inundation area of the Tisza that has an extremely hard sedimentary ground variably saturated with native soda and full of halophilic vegetation (RAPAICS, 1926). The particular hydro-

graphic circumstances as the different degree of the water sweating from the strata along the sharp border-line of the vegetation-cover developed in solonchak and solonetz provided an opportunity to solve several unelucidated problems — mainly concerning soil-ecological and soil-physical factors. In the course of our investigations it was ascertained that — apart from the hydrolgraphic resp. chemical factors of soil — also its physical factors — first of all the distribution according to the size of granules — may have a decisive influence on the composition of grass associations in soils saturated not at all or only in some degree with native soda.

Materials and Methods

The phytocoenologico-synecological investigations of the reserve at the lake Dongér began in the spring of 1965. Besides the systematic surveyings performed resp. repaeted .n various aspects, in July of the year also the exposure of the soil profile of the single pgrass, resp. meadow associations took place. In the course of the laboratory elaboration of the soil samples collected, we have determined the percentage of the total salt content measured on the basis of electric condutivity (SIGMOND's version os WHITNEY-MEANS's method) and, besides the sodic alkalinity, that of calcium carbonate, of organic matter. For clearing up the quality of the water-soluble salts and their quant.-tative distribution in the ground levels, we have performed also the analysis of the watery soil extract, resp. the identification of the changeable kations (bases) of soils. We have measured the moisture content of the soils of various plant associations, as well.

The investigation of the granule-composition of ground, the results of which are reflecting more than anything the physical characteristics of its solid phase, was carried out by applying during the hydrometric procedure an areometer of standard size. We have separated from the evaluation curves and evaluated two sand franctions with a granule diameter of 1,0—0,25 and 0,25—0,05 mm, two silt fractions with that of 0,05—0,01 and 0,01—0,005 mm, as well as two clay fractions with that of 0,005—0,001 and 0,001 mm. The perspicuity of data is promoted by complex graphs. In these we have recorded the percentage of physical sand, the soil character, the six ground fractions, the values of the total salt and soda percent as well as that of moisture content from various depths of the excavated and investigated ground levels.

Results

I. Associations developed under the influence of soils of loose structure under glycophilic and halophilic conditions

The nature conservation area of the lake Dongér is lined to the west in a distance of about one km and half with a hill row of sandy loess soil resp. of sand soil covered with loess. As a result of the rearrangement of its material in an aeolian or fluviatile way, there were formed ridges and berms of sandy mud ground in the western area of the flat in the environs of lake. On them there came about a vegetation cover of hard sand, resp. loess steppe. In their species combinations there take place sporadically also species from which a conclusion can be drawn concerning the existence of ancient forests. Such species are e. g.: *Fragaria collina*, *Thalictrum minus*, etc.

1. *Astragalo-Festucetum rupicolae danubiale* Soó (1939) 1964.

In the western area of the reserve, on the ridges of hills projecting into the flats eroded by inundations, resp. on their slopes. From its species combination we can infer minor biogene effects (mainly pasturing).

Soil Conditions

Its sand soils of chernozem or black-earch character are sandy or light mud of loose structure. Its granule composition, at least in levels A and B, are such that its part to be desilted only rarely surpasses 50 p. c. and in it the silt fraction of 0,05—0,01 mm is dominant. As a consequence of its localization on a high level, the content of soil-moisture is low. The sodium accumulation does not reach the degree of alkalinity.

Vegetation Conditions

Its species combination mostly differs from those described from other areas of the territory between the Danube and Tisza. There are missing in our area the subassociations showing a transition towards *Festucion vaginatae*. As depended upon the relief conditions, there are two subassociations to be separated:

1a — — *poëtosum angustifoliae* Soó 1957

In the higher zone of hill ridges. There develops a double grass level. From its group- resp. association character species there are to be found: *Festuca rupicola, Astragalus austriacus, Chrysopogon gryllus, Agropyron pectinatum.* But there are dominant mainly the *Festuco-Brometea* species from which *Poa angustifolia, Ononis spinosa, Cynodon dactylon* are differential species. A species of *Quercetalia* is: *Thalictrum minus.*

1b — — *caricetosum distantis* (Nova subass.)

On the slopes of lower relief of the hill ridges where the ecological effect of the temporarily high subsoil water appears. It is an association indicating the vicinity of subsoil water; in this way, it shows a transition towards *Agrosti-Caricetum distantis* (Rapaics, 1927) Soó 1930. — The number of its group-, resp. association, character species is decreasing. There is a similar situation also concerning the *Festuco-Brometea* species. Instead of them, number and dominance value of the *Arrhenatherion*, resp. *Molinio-Arrhenatheretea* species is increasing. There enter; *Alopecurus pratensis, Trifolium repens, Centaurium minus, Trifolium pratense, Knautia arvensis.* Its differential species is: *Carex distans.*

2. *Potentillo-Festucetum pseudovinae danubiale* Bodrogk. 1959

It is a pasture association, developed in the south-western area of the reserve, on ridges of hills protruding or forming islands, under relief conditions that are similar to the former ones. The adjacent farms are here nearer, the grazing of sheep and small livestock is therefore increased. It may be supposed that *Astragalo-Festucetum rupicolae* used to be here the dominant grass association.

Soil Conditions

They are similar to the soil of the former association, consisting mainly of a sand ground of chernozem character. Its sand fraction is somewhat higher than that demonstrated there (50 to 60 p. c.).

The layers of soil profiles investigated here can, therefore, be considered as a light and sandy mud soil (Fig. 1). The total salt amount, accumulated by absorption of the inland waters that from time to time inundate this zone, reaches 0,1 percent only in the lower strata, and the soda alkalinity 0,05 percent. In this way, even the lower strata cannot be considered as sodic ones. It is therefore easy to understand that there does not take place even a single euhalophilic species in its coenoses.

Conditions of its associations

Its species combination, aspect-changes largely coincide with those described from other regions between the Danube and Tisza (BODROGKÖZY, 1959). From the species *Festucion rupicolae*, resp. *Festucetalia valesiacae* it is worth while mentioning: *Stipa capillata*, *Silene otites* ssp. *pseudotites*, *Verbascum phoeniceum*, *Echium italicum*, etc.

2a — — *cynodontetosum* Soó 1955

The mass multiplication of some *Festuco-Brometea* species as differential species can be considered as a result of an increased zoogene effect. This subasociation is, therefore, very frequent in our area.

The facies may be formed in areas, less exposed to pasturage and treading, by *Filipendula vulgaris*, in other areas by *Stipa capillata*.

2b — — *caricetosum distantis* BODROGK. 1959

The subassociation is also here of subsoil-indicating character, similarly to the former association.

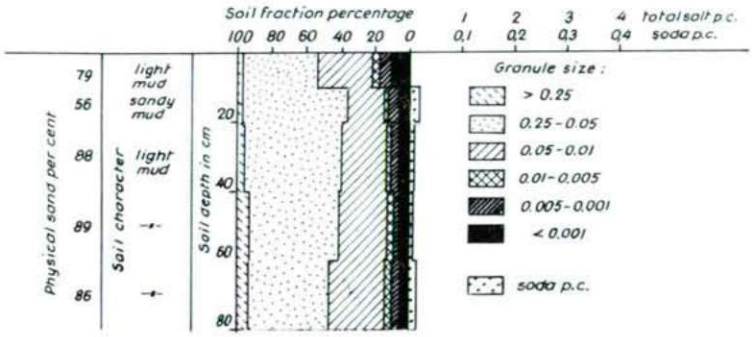

Fig. 1. Profile No. 8 of the light mud-soil of *Potentillo-Festucetum pseudovinae*.

3. *Artemisio-Festucetum pseudovinae danubiale* Soó 1963

This association is generally known as an artemisia steppe of solonetz, in the Hungarian Plain and particularly in the territory east of the river Tisza. Its occurrence in the territory between the Danube and Tisza may be presumed only from MOESZ's data (1940). Our recent investigations have confirmed Soó's effort (1964) to separate its phytocoenoses from those in the territory east of the river Tisza at least as a geographic variant.

Its species combinations to be found in the reserve at the lake Dongér are somewhat differring from those published from the western area of the territory between the rivers Danube and Tisza.

Soil conditions

Artemisio-Festucetum pseudovinae is, as to its localization, similarly zonal. It occurs under the zones of the former two associations, on lower hill ridges and

berms where the soil water is, mainly in the spring period, rather high, owing to the continuous flux of layer water (Fig. 2).

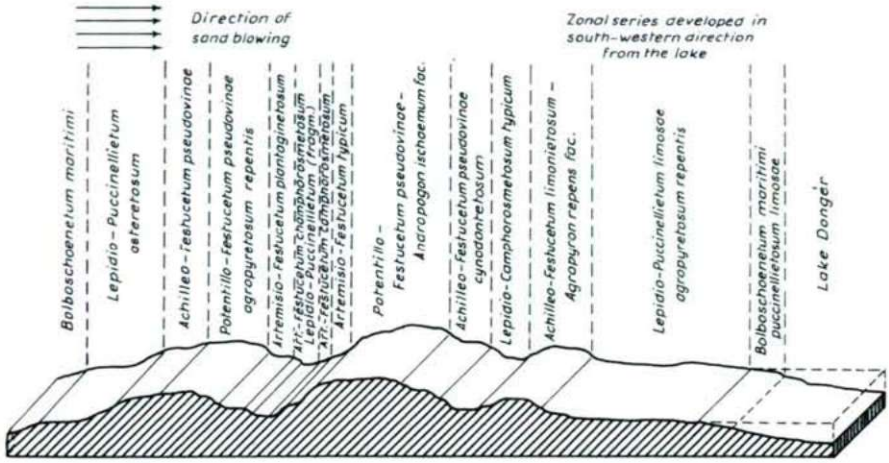

Fig. 2. Zonal arrangement of the subassociations of *Artemisio-Festucetum* (Nov. 2nd 1968), west of the lake Dongér.

Sodaic alkalinity can be demonstrated already from the soil surface. The salt movement is important even in the vegetation period; at the same time, in the profiles the separation of the single strata can already be observed well. We have here, therefore, solonchak — solonetz. For characterizing, we are presenting soil profile No. 11. Owing to the eluviation in soils, its A-level has but a minimum sodium-salt content so that even some glycophytic species having not deep roots may obtain a considerable participation in covering. In the B_2-level there is, however, already a considerable content of soda (0,2 to 0,3 percent) and of total salt (2,0 to 2,5 percent) (Fig. 3).

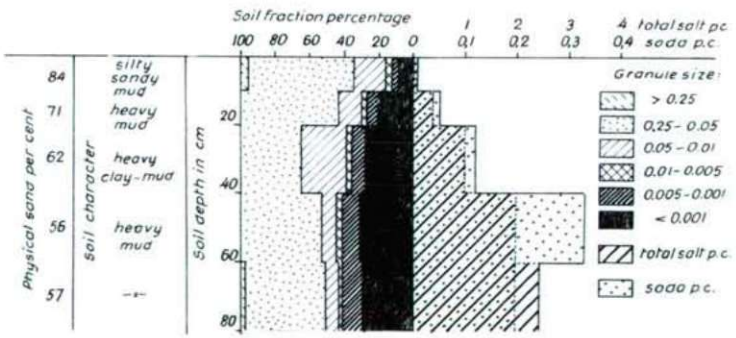

Fig. 3. Soil profile No. 11 of *Artemisio-Festucetum*

Association conditions

The peculiar combination of the glycophilic and halophilic species is characteristic of its species combinations, as generally observed in case of *Artemisio-Festucetum*. The appearance of the not deeply rooted *Festuca pseudovina* var. *salina*, *Achillea collina*, *Bromus mollis*, *Poa bulbosa* v. *vivipara*, *Trifolium campestre*, *Cynodon dactylon*, *Trifolium arvense* that are dominant in the eluviated A-level, is indicative of the insufficiency of calcium carbonate in that layer.

The components *Festucion pseudovinae* and *Festuco-Puccinellietea*, as well as *Artemisia monogyna* ssp. *salina*, *Limonium gmelini*, *Podospermum canum* are indicating the high alkaline values of level B. — The most important thing for us is, however, the appearance of the characteristic species of the geographical variant of association, *Plantago maritima* and *P. schwarzenbergiana*. They are indicative of solonchak — solonetz of low slack-water content, ensuring due water supply, coming into being in a sandy mud soil of a higher salt and soda content in its B-level.

3a — — *plantaginetosum maritimae* (Nova subass.)

As a typical subassociation, it is the most wide-spread in our area. *Plantago maritima* and *P. schwarzenbergiana* can be regarded as its differential species.
Facies: *Achillea collina* in eluviated solonchak — solonetz of A-level that may be called a mediocre steppe.
Facies: *Camphorosma annua*

It occurs in case of minor superficial erosions in the zone of the association if the solonchak-solonetz strata get to the neighbourhood of surface or the sodium salts are washed together into these depressions. As a result of that, some *Festuco-Puccinellietalia*, resp. *Puccinellion* components may occur as *Cerastium dubium*, *Lepidium perfoliatum*, at some other time *Puccinellia distans ssp. limosa*; *Camphorosma annua* having, anyway, the greatest participation in covering. It is showing a transition towards *Lepidio-Camphorosmetum festucetosum pseudovinae*.

4. *Lepidio-Camphorosmetum annuae* (RAPAICS 1927) Soó 1957

It occurs in the western area of the reserve, on the bottom of hill ridges and berm-like protrusions in the third zone that follows the direction of the relief settlement where, as a result of water erosion, the stratum of salt accumulation in the solonetz level got to the surface (Fig. 4). It is forming long stripes running zigzag, following the meanders of the zone. The extent of its substance in our area is, anyway, not considerable.

Soil ecology

The surface layers of its solonchak formed in a sand ground of chernozem character are containing 40—50 percent desiltable fraction, about 50 p. c. of which being made of two clay fractions with granule diameters of 0,005 to 0,001 and $<0{,}001$ mm. The lower layers are somewhat harder, and the medium mud turns into a heavy clay-mud soil (Fig. 5).

The movement of sodium salts is considerable, the surface accumulation in spring can be found in July in layers of 10 to 40 cm depth. Both the soda alkalinity and the percentage of total salt are extremely high; at the same time, the soil moistuer on the soil surface was in July hardly 5 percent (Fig. 5).

Vegetation conditions

The phytocoenological question, where the substances of *Lepidio-Camphorosmetum annuae* belong to, cannot be always decided easily. Because of the extreme habitat conditions the species number is low enough. In the border-area of the geographical distribution of the association important character species are missing.

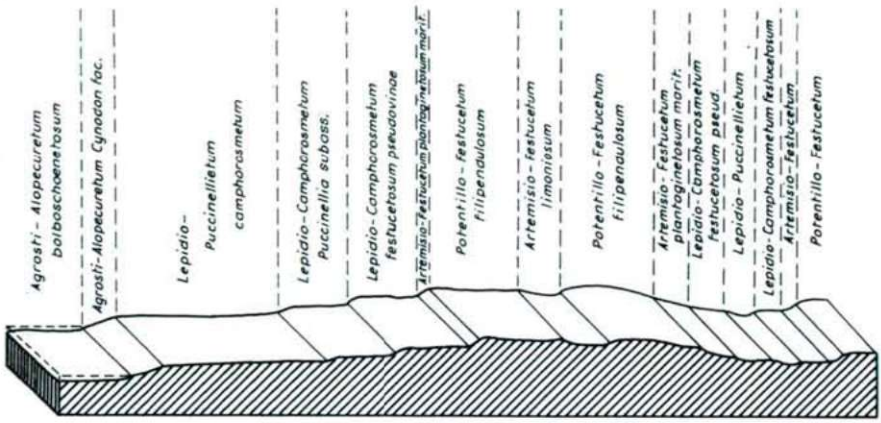

Fig. 4. Zone conditions of *Lepidio-Camphorosmetum annuae* in thewsətern area of the reserve (November 2nd 1968).

Thus the typical solonchak species, *Plantago maritima*, is often substitutes for another species, *Lepidium crassifolium*. As depended upon the ecological conditions of ground, there can be separated more associations of its:

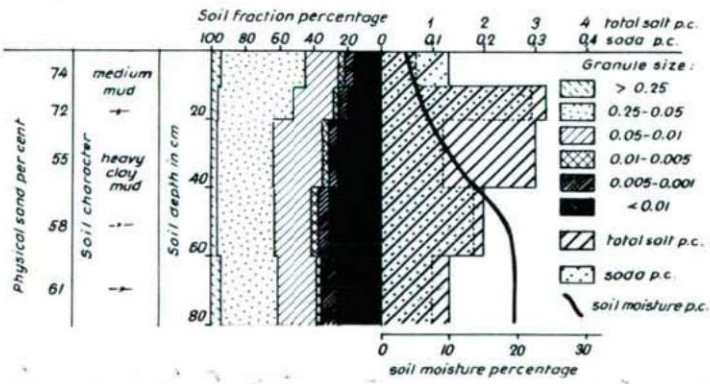

Fig. 5. Soil profile No. 2 of *Lepidio-Camphorosmetum* (Cf. explanatory note in Fig. 3).

4a — — *lepidietosum crassifolii (typicum)* (Nomen novum).

In the highest area of the zone of association where the influence of subsoil water may still be considerable but the surface is covered by water only for a short time. The highest salt concentration of Hungarian licks is to be observed consequently in this place. In the reserve, at any rate, it can be noticed only in smaller spots.

Its facies is: *Plantago maritima.*

4b — — *puccinellietosum limosae* BODROGK. 1962

In the lower area of the zone of the association. It often shows a transition towards *Lepidio-Puccinellietum*. As a resu t of the higher water content, resp. lower salt concentration of soil, there occur as differential species: *Puccinellia limosa, Plantago schwarzenbergiana, Lepidium perfoliatum.*

Puccinellia limosa, Plantago maritima are facies-forming.

4c — — *festucetosum pseudovinae* BODROGK. 1962

As a consequence o the erosive activity o the rainwater accumulated in the depressions of lower hill r dges and berm zones, there were formed bowl- or basin-like dips of 1—5 sq. m extent. In them sodium salts got to the surface. In this way, the *Camphorosma* facies of *Artemisio-Festucetum pseudovinae* has changed into a subassociation of that association. While the phytocoenoses 4a and 4b take place in the zone providing for them the optimum of habitat conditions, the subassociation *Festuca pseudovina* is showing an extrazonal appearance (Fig. 4). Although the amount of sodium salts does not reach the quantity demonstrated in case of 4a this may be considered as the most extreme habitat of *Lepidio-Camphorosmetum* The soil moisture that has diminished more and more, is namely increasing the physiological efficiency of sodium salts. The ground frequently becomes a soloth.

5. *Lepidio-Puccinellietum limosae* (TOPA 1939) SOÓ 1957

Following the further depression of relief in the western area of our territory, we get to the upper zone of smaller or larger back-water areas, so-called flats among the ridges of hills (with an extension from some 100 sq. m to more ha's) (Fig. 6). These are covered by the spring inland water for a longer time and also the subsoil water is nearer to the surface.

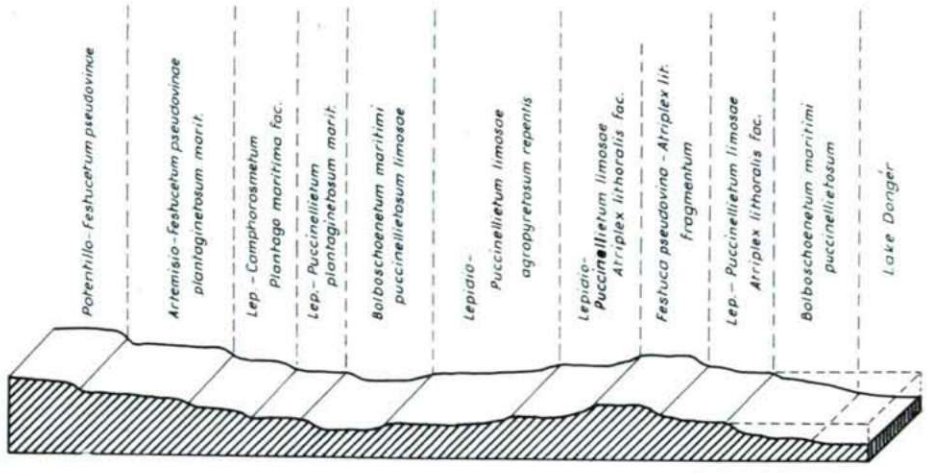

Fig. 6. Zonation of the subassociation of *Lepidio-Puccinellietum* at the western shore of the lake Dongér

Soil-ecological conditions

The excavated and investigated soil profiles differ from those of soils in the territories between the Danube and Tisza both in the respect of their physical composition and of their chemical characteristics. Evaluating the results of the investigations in its profile No. 1, we can ascertain that in that zone the degree of sand blow, resp. covering with sand does not at all reach the degree observed at the soils of *Lepidio-Camphorosmetum*. Concerning its soil fractions, the desiltable part reaches the 80 percent already on the surface and from that more than 50 percent falls to the two clay fractions.

From chemical point of view, the sodium salts don't accumulate even in the summer aspect in a soil level higher than 40 to 60 cm. For the combination of vegetation, first of all the influence of surface layers is decisive. However high may be the percentage of soda alkalinity and total salt here too, it is highly compensated by the favourable hydrographic conditions in the summer months, as well. The moisture content of soil on the surface reaches 25 percent even in July (Fig. 7). It can be explained with that that besides the expressedly halophilic species there occur also glycophilic species as: *Typha angustifolia, Alisma lanceolatum, Agrostis alba.*

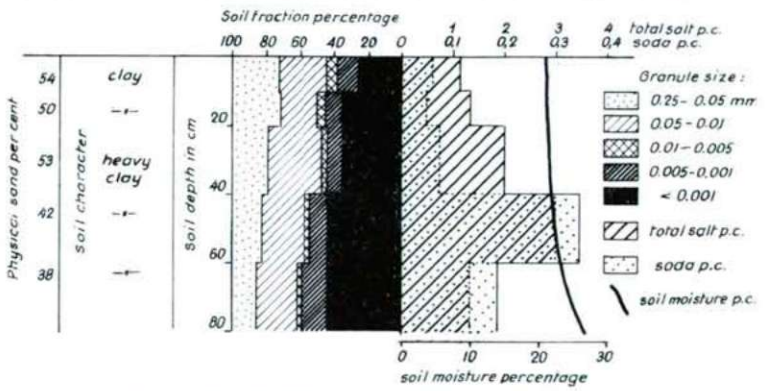

Fig. 7. Soil profile No. 1 of *Lepidio-Puccinellietum*

Association conditions

Depending on the physical, chemical and hydrographic characters of the soil levels lying near the surface, there develop highly varied species combinations on our area, too. By means of differential species, the following subassociations could be separated:

5a — — *camphorosmetosum* (Moesz) 1940 Soó 1957

It shows a transition towards the former association both from the point of view of soil ecology and that of phytocoenology. In our area it is, consequently, not important: but it forms sporadically wider zones than *Lepidio-Camphorosmetum* (Fig. 4).

5b — — *puccinellietosum (typicum)* Soó 1964

It is under more favourable hydrographic conditions than the former one. Its habitat is covered with shallow water in a great part of the vegetation period.

In the summer and autumn aspects, there occur in its species combinations alkaline silt-plant species as *Plantago tenuifolia, Myosurus minimus*. The covering value of *Nostoc commune* is considerable. At the same time, there are still missing: *Aster tripolium* ssp. *pannonicus, Eleocharis uniglumis, Agrostis alba, Juncus compressus.*

Puccinellia limosa develops sporadically pure substances. Other species occur only blade by blade.

Here, in the borderland of the distribution of *Lepidio-Puccinellietum*, it is often difficult to separate it from the species combinations of the *Puccinellietum limosae hungaricum* (RAPAICS 1927) SOÓ 1930 in the hard soil territory east of the river Tisza what can be explained first of all by the harder structure of its soil as compared with that of the territory between the Danube and Tisza.

5c — — *asteretosum pannonici* BODROGK. 1962

Its soil ecological conditions are considerably more favourable than that of the type: besides similar water supply, the soda, resp. total salt content on the surface of soil is diminished. Its phytocoenoses are, consequently, richer in species, first of all the *Agrostion albae* species occur, similarly to other regions of the territory between the Danube and Tisza (BODROGKÖZY, 1962).

Juncus compressus, that here can be considered as a vicarious species of *J. gerardi*, is facies-forming.

Plantago tenuifolia may be facies-forming, as well. In case of the formation of a rain maximum in a rainy spring or June, an alkaline silt vegetation develops.

5d — — *agropyretosum repentis* (Nova subass.)

Its species combination is fu ly unaccustomed in *Lepidio-Puccinellietum*. Its stands are of double level. Its upper grass level is formed by *Agropyron repens, Rumex stenophyllus, Bolboschoenus maritimus* and the lower one by *Puccinellia limosa, Aster tripolium* ssp. *pannonicus, Alisma lanceolatum, Eleocharis uniglumis.* Its soil is differring from that of *Lepidio-Puccinellietum* of typical appearance, being near to the meadow solonetz where the A-level is eluviated so much that only a minimum of soda alcalinity and total salt amount can be demonstrated. Below ten cm, however, their value — particularly that of soda alkalinity — quickly increases. Accordingly, the glycophilic *Agropyron* uses the upper ten cm soil layer. Also the continuous layer-water supply of the subsoil from the direction of sand ridges is of compensating influence.

5e — — *juncetosum ranarii* (Nova subass.)

We have found recently in the middle area of the territory between the Danube and Tisza, among alkaline silt associations, in more places, *Juncus bufonius* ssp. *ranarius*. Previously, it was only known from the area of the lakes Fertõ and Balaton (SOÓ—JÁVORKA, 1951; SOÓ—KÁRPÁTI, 1968). Supposedly, it has got by means of birds into the zone immediately at the shore of the lake Dong r, as well. In our area it is not only a participant of a silt association. In the species combination at the shore of the lake *Lepidio-Puccinellietum* is occurring as a differential species together with *Plantago tenuifolia.*

In its soil profile excavated, in the ten cm layer on the surface, the desiltable fraction is lower than 50 percent, with low soda and total salt content. In the deeper soil strata, clay soil is substituted for the covering sand.

6. *Festucetum pratensis hungaricum* Soó (1938) 1955

It occurs along the western border-line of the reserve at the lake Dongér — immediately in the neighbourhood of the cultivated areas, in the deepest zone of the flat where a standing water supply is ensured by the oozing layer water. In this way, in our area it can be considered as an expressedly glycophilic association.

6a — — *caricetosum vulpinae* (Nova subass.)

It can be found in the areas covered with water for the longest time, together with *Agrostis alba, Eleocharis palustris,* as well as with other *Molinion, Molinietalia,* and *Molinio-Arrhenatheretea* species. Facies-forming is: *Dactylis glomerata,* in the rather dry areas. In its species combinations it occurs with the *Molinio-Arrhenatheretea,* resp. *Festuco-Brometea* species.

II. Plant associations developed in hard soils

East of the lake Dongér, both the soil ecological and the phytocoenological conditions are showing a very strong contrast as compared to the former ones. The wind-blown sand is here already only of minimum effect. In this way, in the area inundated by the Tisza, one of the hardest meadows, resp. solonetz of the Hungarian Plain could come into being. Their covering vegetation sharply differs from those described in the area a few hundred metres farther in the west of the lake. The differences arisen from the physical structure of soil are highly emphasized also by that the eastern part is no more influenced considerably by the layer waters oozing from the direction of the western border of the reserve. The level of subsoil water is consequently lying deep and the water cannot be utilized at all by the vegetation or only with difficulty.

The relief differences that develop the zonation conditions of the single plant associations do not reach at all those established in a loose soil. Starting from the highest zone, the following phytocoenoses could be identified:

7. *Achilleo-Festucetum pseudovinae* (Magyar 1928) Soó 1945

It is a glycophilic coenosis formed on ridges of chernozem soil with comparatively higher relief level and inundated by inland waters only scarcely. It is to be supposed that before the arrangement of inland waters, there were dominant more favourable hydrographic conditions in this higher zone, as well. This is referred to also by the *Agrostion,* resp. *Molinietalia* species being sporadically present even in our days.

Its soil ecological conditions:

It is to be mentioned for characterizing physically its chernozem soil that the so-called desiltable part of a granule size smaller than 0.05 mm is exceeding 60 percent even in level A_1 (0 to 10 cm). Increasing evenly in the direction of lower levels, under 40 cm this value is 90 percent. The amount of the two clay fractions (with a granule diameter of 0,005—0,001, resp. <0,001 mm) is higher than 50 percent of the desiltable part (Fig. 8).

According to the results of chemical analysis, there could not be demonstrated any content of total salt, resp. soda of a considerable amount in the A-level (0 to 20 cm).

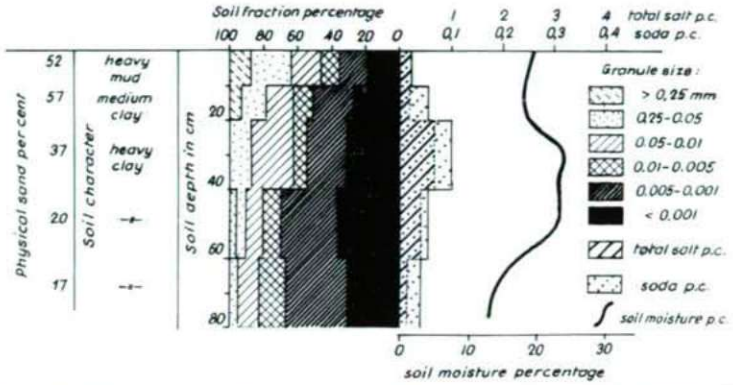

Fig. 8. Soil profile No. 5 of the *Alopecurus pratensis* facies of *Achilleo-Festucetum limonietosum* medium clay

Vegetation covering

Depending on the chemical and hydrographic character of the soil, there could be separated three subassociations in our area.

7a — — *achilleetosum (typicum)* Soó 1964

It is a typical occurrence of the association. The large sheep-runs of the reserve and its environs are formed by this subassociation. As its soil profiles don't contain a larger amount of sodium salts in the deeper layers, either, there occur no halophilic species there — except some pseudohalophilic *Festucion pseudovinae,* resp. *Artemisio-Festucetalia pseudovinae* species. It can be considered, therefore, as a dry pasture of chernozem soil, belonging rather to the *Festucion sulcatae (=rupicolae)* federation. The *Festuco-Brometea,* resp. *Festuco-Bromea* components are dominant.

7b — — *limonietosum* SLAVNIĆ 1948 *(Ranunculetum pedati* subass. *Statice Gmelini)*

In its soil there can already be demonstrated a larger amount of salt, resp. soda, mainly in level B under 20 cm. The chemical composition of its profile is referring to a meadow chernozem soil of solonchak character that is saline in its depth. The glycophilic species without deep roots are not influenced by the 0,02, resp. 0,06 percent soda and 0,04 percent total salt content of level A. The sodium salts accumulated in deeper layers are referred to by the occurrence of *Limonium gmelini* as differential species. This subassociation is present as a transitory species combination in the border zone of the sometime extensive *Achilleo-Festucetum pseudovinae* bordering on soils saturated with native soda. In the dry pastures with sand grounds of chernozem character between the Danube and Tisza, there may develop a border zone similar to *Potentillo-Festucetum pseudovinae* (BODROGKÖZY, 1962), without considering this type of pastures as a saline pasture.

Facies: *Alopecurus pratensis.* In our area under rather favourable hydrographic conditions it is fairly frequent. Its detailed soil ecological characteristics may be observed in Fig. 8.

8. *Artemisio-Festucetum pseudovinae pannonicum* Soó 1963

The immense artemisia-steppes of the licks east of the river Tisza that are formed on a meadow solonetz extend as far as the eastern area of the reserve at the

lake Dongér. The high slack-water content of their meadow clay soil and the high values of the accumulated sodium salts are connected with a rather low soil-moisture content. Therefore, we can understand the poverty of species that generally characterizes these solonetz steppe meadows. Their general phytocoenologico-synecological characterization is known partly from the classical habitat, Hortobágy (MAGYAR, 1928, 1930; Soó, 1934; SZABOLCS, 1954; BODROGKÖZY, 1965a), partly from the solonetz of the Ancient-Maros-valley (BODROGKÖZY, 1966). At present we want to make known the synecological conditions of its transitory border lands.

Soil-ecological conditions

As to the physical structure of its excavated soil profiles, it proved to be considerably harder than it was known so far. The desiltable fraction of granule diameters smaller than 0,05 mm approaches 80 percent already in level A. One-third of that is colloid-like, $<0{,}001$ mm φ. In the columns of the solonetz level B_1, however, it reaches 50 percent of the desiltable part and can, therefore, be considered as heavy clay.

By the means of chemical analysis a transitory character may be established because — as distinguished from those beyond the Tisza — a high soda alkalinity percentage can be demonstrated. In this way, we can ascertain the presence of steppe-like meadow solonetz of solonchak character (Fig. 9). Its sporadic occurrence in the south-eastern region of the territory east of the river Tisza is known (ÁBRAHÁM, 1967).

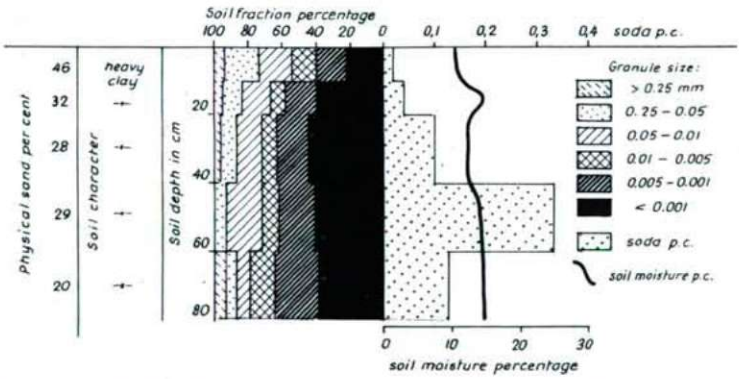

Fig. 9. Soil profile No. 4 of *Artemisio-Festucetum* from the eastern area of the reserve

Association conditions

In its phytocoenoses, apart from the species known from other artemisia steppes, there may occur blade by blade also some species reflecting a solonchak character as *Plantago maritima, P. schwarzenbergiana, Lepidium perfoliatum.* Their mass appearance as facies (RAPAICS, 1927; MOESZ, 1940; Soó, 1947; SLAVNIĆ, 1948) already belongs to the different units of *Artemisio-Festucetum danubiale.*

8a — — *festucetosum pseudovinae (typicum)* (WENDELBG. 1943) Soó 1947

In our area it is insignificant because, besides the group participation of the p ecies inside the class *Festuco-Puccinellietea,* also the spread of some glycophilic

species, first of all of the *Festuco-Brometea* and *Festuco-Bromea* species is considerable.

Facies: *Achillea collina*. In its species combinations with the *Trifolium arvense, Bromus mollis, Trifolium campestre, Poa bulbosa* v. *vivipara* species.

From its appearance we can conclude that the eluviation of A-level is more increased than that of the type. This *Achillea collina* facies generally develops, anyway, in meadow solonetz having a steppe character in the middle and depth.

8b — — *camphorosmetosum* (RAPAICS 1927) WENDELBG. 1943

As a result of the eroding activity of rain water, the soil surface of the artemisia steppes may be submitted to an erosion of such degree that in it bowl- or basin-like depressions can occur where the meadow solonetz layers with solonchak can get on or near the surface. Owing to the impermeable layer formed by heavy clay, the accumulated rain water cannot be absorbed. After drying up of these longlasting slack-water pools, the percentage of the total covering of steppe species decreases. They are substituted for by *Puccinellion limosae* elements — as differential species. With that, the process of formation of extrazonal, secondary berms begins.

9. *Camphorosmetum annuae* (RAPAICS 1916) SOÓ 1933

Its distribution in the area of the reserve is unimportant. Comparing its ecological relations with those investigated in other areas of the territory east of the river Tisza, it can be established that its soil profiles investigated along the Dongér are of heavy clay, its soda alkalinity values, resp. its salt content are higher. The effect of these is, however, compensated in some degree by the more favourable hydrographic conditions. It is to be attributed to that that its species number is higher than observed anywhere else.

10. *Puccinellietum limosae hungaricum* (RAPAICS 1927) SOÓ 1930

The eastern part of the reserve — owing to the harder soil conditions — being less dissected, the halophilic vegetation is giving not at all a varied picture like that observed in the western part. Therefore, the *Puccinellietum* stands of solonetz are found first of all in the bank zones of brooks winding in zigzags, eroded by the Tisza or other inland waters. The solonetz layers are, here too, near to the surface.

These brooks are in rainy years, rich in precipitation, water-covered for a longer time, and the usual *Puccinellietum* species combination is mixed with. *Potamion* species, as well.

Soil ecological conditions

As to its physical composition, it is nearly identical with the soil conditions of *Camphorosmetum*. Accordingly, in level A there can be desilted 80 percent, in level B_1 and B_2 respectively already 90—95 percent, i. e., the fraction is smaller than smaller 0,05 mm granule diameter. Three-fourth of it is then clay with granule size smaller than 0,005 mm (Fig. 10).

Its soil-chemical character is reflected first of all in the change in the amount of sodium salts according to vegetation zones. There is generally afforded an increased solonchak character by the soda alkalinity higher than the accustomed one, resp. by the calcium carbonate content.

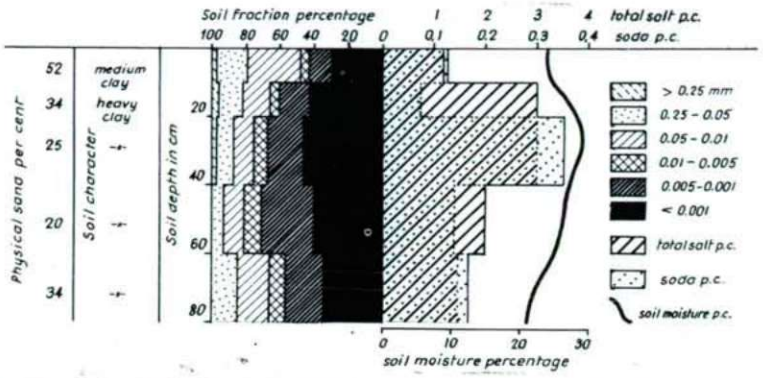

Fig. 10. Results of the physical and chemical investigations of soil profile No. 7 of *Puccinellietum limosae* typicum

Vegetation conditions

The association, corresponding to the relief difference developed by the inland-water erosion, makes possible to separate more zones. The species combination of the single coenoses accordingly changes:

10a — — *puccinellietosum (typicum)* (Nomen novum)

It presents itself in our arae in the high est zone of the association. The complex effect of the chemical and mainly of the hydrographic conditions often results in the development of the *Camphorosma annua* facies (Fig. 11).

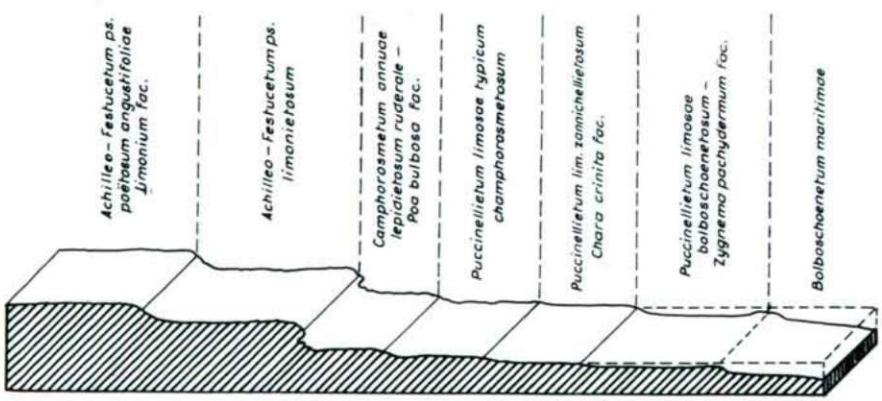

Fig. 11. Zonation conditions of the subassociations of *Puccinellietum limosae* in a flat eroded by inland water, in the eastern area of the reserve.

Its species number is richer than usual. In years of more precipitation the conditions of soil moisture make possible even in this zone the considerable distribution of some alkaline silt plant species as *Plantago tenuiflora*. At the same time,

the accumulation of sodium salts is higher even in the B-level under 10 cm than the usual one. The percentage of the total salt content can reach, e. g., in July 3 p. c. (Fig. 10).

10b — — *zannichellietosum* (Nova subass.)

It develops in the lower zone of the association as the area is covered with water for a longer time — sometimes till July. Its differential species are, apart from *Zanichelia palustris*, facies-forming *Chara crinita* and a particularly large mass of *Zygnema pachydermum* (det. UHERKOVICH), with *Nostoc commune*.

10c — — *bolboschoenetosum*

It forms a transition towards *Bolboschoenetum maritimi* and along the brooks it occupies the deepest zone of the association. In its coenoses, a triple-level distribution takes place: there are in the upper level *Bolboschoenus maritimus, Phragmites communis,* in the central one *Puccinellia, Eleocharis* and in the water zone *Batrachium, Zygnema pachydermum, Chara crinita.*

Facies forming is: *Zygnema pachydermum*

10d — — *agropyretosum repentis* (Nova subass.)

It is distributed first of all in meadow solonetz flats of wide extension. Phytocoenologically it is near to a subassociation of *Lepidio-Puccinellietum* of similar name. Its ground is, as to its physical structure, extremely hard. Three-quarters of the desiltable part coming close to 90 percent is given by the two clay fractions. In the levels B_2 and BC, nearly 60 percent of the soil is afforded by the colloid-like clay fraction of $<0{,}001$ mm granule diameter.

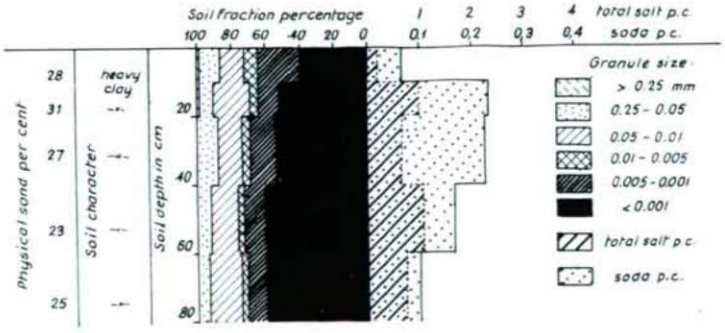

Fig. 12. Soil-ecological conditions of *Puccinellietum limosae agropyretosum (repentis)*, on the basis of laboratory invetigations of soil profile No. 13, resulting from the eastern area.

The A-level of this meadow solonetz, that from chemical point of view is of solonchak character, is eluviated enough in respect of sodium salts. The value of soda alkalinity is, however, — as regards the mass occurrence of the glycophilic *Agropyron repens* — rather high: 0,05 percent and under 10 cm this value quickly increases (Fig. 12). The dominant role of this species can be explained first of all with the compensatory influence of the favourable hydrographic conditions.

In its phytocoenoses there developed a triple grass level. The upper level is composed of *Agropyron repens, Rumex stenophyllus, Bolboschoenus maritimus*; the

middle one of *Puccinellia limosa, Eleocharis uniglumis*; and the lower one of cotyledonous silt-plant species: *Plantago tenuiflora, Pholiurus pannonicus,* resp. *Lotus tenuis.*

11e — — *atriplicetosum litoralis* (Nova subass.)

It occurs in areas along the lake-shore grazed in an increased degree, first of all as a pasture for geese. The effect of sand-blast cannot be seen any more. There was produced here a solonchak meadow where the increased fertilization has resulted in a nitrogen accumulation. In this way, the differential species of the subassociation come from the nitrophilic halophytes as *Atriplex litoralis, Lepidium ruderale, Atriplex hastata* v. *salina.* In addition to these there are often cotyledonous silt plants, mainly *Myosurus minimus, Cerastium dubium, Plantago tenuiflora.*

Facies: *Hordeum hystrix* (first of all on a higher relief level). The soil both of the subassociation and of its facies is similar to that described under 11 d, from both physical and chemical points of view.

12. *Agrosti-Alopecuretum pratensis crisicum* (Nomen novum)

In our area, it is in the flats visited by inland water, immediately beneath the zone of *Puccinellietum limosae.* Depending upon its soil-ecological relations, even more subassociations of its can be separated. These depend first of all on hydrographic factors.

12a — — *alopecuretosum pratensis (typicum)* SLAVNIĆ 1948. In the reserve, the subassociation is less distributed. In its species combinations there occur the characteristic species of the marshy meadows in the territory in the east of the river Tisza, *Rorippa silvestris* ssp. *kerneri, Ranunculus lateriflorus,* etc.

12b — — *agropyretosum repentis* (Nova subass.)

It is the most distributed *Agrosti-Alopecuretum* variant of the area showing that *Agropyron repens* feels very well in these marshy meadows just as the former associations.

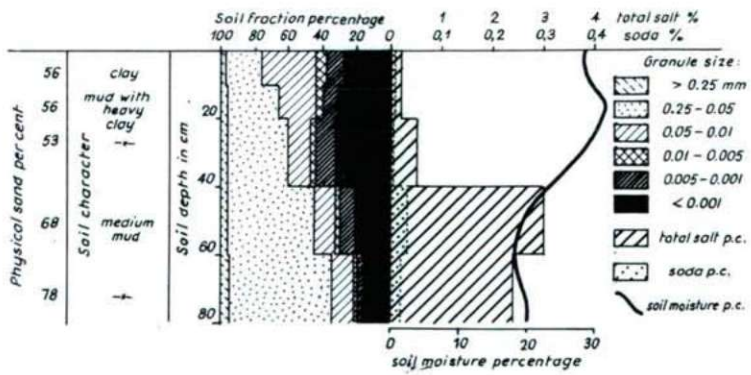

Fig. 13. Soil profile No. 3 of the *Agropyron repens* subassociation of *Agrosti-Alopecuretum pratensis,* from the border-line of the western and eastern areas of the reserve

It could be ascertained in the course of the chemical analysis of its soil that in the reserve at the lake Dongér — just as in the investigated soil profiles originating from other areas of the Hungarian Plain — the total salt percentage is rather important at the most only in the lower layers. The soda content is of minimum quantity (Fig. 13).

This is reflected in the species combination of the subassociation, as well. There does not occur any halophilic species, except some pseudohalophilic ones.

12c — — *poëtosum angustifoliae* (Nova subass.)

In the areas where — owing to the functioning of the Dongér canal — the old marshy meadows had gradually dried up and that process was not followed by alkalization, the hygrophilic species were from year to year more and more substituted for by mezo-, resp. xerophilic species. The first step like that is the transition of *Agrosti-Alopecuretum typicum* into the variant of *Poa angustifolia*.

In its species combinations, *Cynodon dactylon, Carex divulsa, C. stenophylla* and later *Trifolium striatum* play a part. Then in time, either *Cynodonti-Poëtum angustifoliae* or *Achilleo-Festucetum pseudovinae* will develop after the draining being increased.

13. *Agrosti-Beckmannietum* (RAPAICS 1916) SOÓ 1933

This association becomes dominant in the eastern part of the reserve, connected with Crisicum, in the deepest relief of the flats eroded by inland waters where in case of a normal distribution of precipitation the area is watercovered in the most part of the vegetation period.

Soil ecological conditions

The soil development bears first of all the marks of the hydrographic conditions. The colloids of stagnant inland waters have plenty of time for deposing. Consequ-

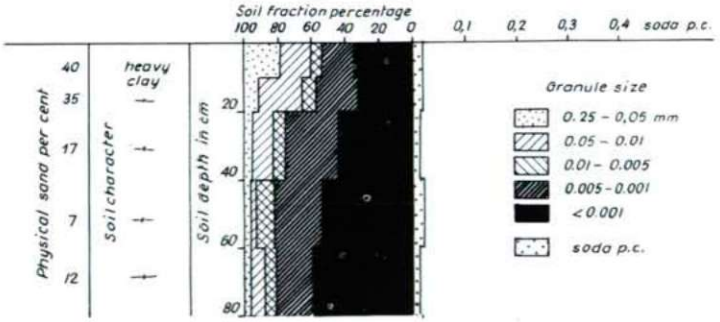

Fig. 14. Soil-ecological conditions of *Beckmannietum eruciformis* on the basis of physical and chemical investigations of soil profile No. 15

ently, in its investigated soil profiles beginning from level B the desiltable part approaches 95 percent and, what is more, these soil strata are built up in 80 percent of the two clay fractions (with granule diameter of 0,005 to 0,001, resp. <0,001 mm).

In the course of the chemical analysis it emerged that it is just as poor in salt and soda as the *Agrosti-Beckmannietum* soils investigated so far in other parts of the Hungarian Plain (Fig. 14).

The development of the species combination of the association is determined first of all by the physical structure and water supply of the ground. It can be explained with that the euhalophilic species have mostly no role at all in these coenoses. In our area, the *Beckmannia eruciformis* of high dominance is associated with *Eleocharis palustris Lythrum virgatum, Mentha pulegium* or blade by blade the elsewhere facies-forming *Bolboschoenus maritimus.*

14. *Bolboschoenetum maritimi continentale* Soó (1927) 1957

It is constituting extensive stands in the zone of the former association, along the shores of the lake Dongér. Depending upon the soil, resp. water conditions, there can also here be separated more subassociations.

14a — — *puccinellietosum limosae* Bodrogk. 1962

In the shore zone of water-covered flats with alkaline soil where this zone is immediately associated with *Lepidio-Puccinellietum* or *Puccinellietum limosae,* it presents itself as a transitory subassociation.

14b — — *crypsidetosum aculeatae* Bodrogk. 1962

The stands of *Bolboschoenetum* beside the shores of the lake Dongér dry up early in dry years. In their lower grass level there develop the differentiated associations of *Crypsis aculeata.* It forms a transition towards the deeper parts of the lake that only dry up for the end of summer, making possible the development of the, *Crypsidetum aculeatae* stands.

Summary

In the present study of the series about the results of the synecological investigation of the halophilic vegetation of the Pannonicum the results of the investigations of the reserve at the lake Dongér for five years are summarized. As the area is at the border of sand soils of chernozem character saturated in different degrees with native soda and of meadow clay soils, it became possible to measure the effect of the physical structure of soil exerted on the halophilic plant associations.

1. If in levels A and B of a sand soil profile of chernozem character there prevails a granule fraction of a diameter smaller than 0,05 mm, the salt concentration is higher than 0,05 percent and the soil-moisture percentage is low, then *Potentillo-Festucetum pseudovinae* is dominant. The species number is high, at any rate without halophilic species. The biogene effect is increased.
2. Under similar soil-ecological conditions, in case of a zoogene effect of smaller degree, *Astragalo-Festucetum rupicolae danubiale* is wide-spread.

Its subassociations are indicating the differences of the hydrographic relations.

3. In case of a similar distribution of the granule fraction if in the soil profiles there take place higher total salt values than 0,05 percent, resp. more considerable soda alkaline values, then we are facing solonchak solonetz approaching the steppe character. In them *Artemisio-Festucetum pseudovinae danubiale* develops. In its species combinations there are: *Plantago maritima* and *P. Schwarzenbergiana.*

In case of a similar physical structure of the soil profile but with a high salt (0,5), resp. soda-alkalinity percentage (0,1), solonchak and possibly solonchak-solonetz appear on the bottom of hill ridges and berms, with low soil-moisture content on the surface. Their vegetation is *Lepidio-Camphorosmetum annuae*. Its subassociations are indicating further differences in relief, alkalinity degree, resp. soil moisture.

4. In the deeper zones of hill ridges and berm bottoms there can be measured lower total salt and alkalinity values: the desiltable granule fraction of the surface-soil layers is larger than 80 p. c. At the same time, the content of soil moisture is treble (July, 1965). These are as before, in the future too, solonchak, resp. solonchak-solonetz. *Lepidio-Puccinellietum* occurs, as well. Its subassociations are the result of further changes in alkalinity and water content.

5. Under similar conditions of hard soils, in meadow grounds having a decreasing relief, resp. a low alkalinity degree, in the layers of which the salt accumulation does not reach even the alkalinity threshold in ecological sense, the percentage of soil moisture is increased owing to the flux of layer water. These marshy meadows are formed by the associations of *Festucetum pratensis, Astero-Agrostetum,* resp. of *Agrosti-Alopecuretum danubiale.*

B. In soils formed on clayey mud, resp. clay:

1. In meadow chernozem soils of higher relief in whose profile the fraction of granule size with a diameter smaller than 0,05 mm is about 80 percent, and the values of total salt, resp. soda alkalinity do not reach the alkalinity threshold in ecological sense, there occurs *Achilleo-Festucetum pseudovinae typicum*, without Euhalophytic species.

2. Under low relief conditions, the soil here has remained hard as before but close to the soil surface a solonetz level has developed. In these meadow solonetz of solonchak character becoming more and more steppe-like, the distribution of *Artemisio-Festucetum pseudovinae* can be observed.

3. In the solonchak-like meadow solonetz that developed on the bottoms of berms zonally and on the berms secondarily, extrazonally, high salt concentration is combined with low soil-moisture content: the vegetation is *Camphorosmetum annuae.* — In case of lower total salt and more favourable soil moisture *Puccinellietum limosae* occurs, with subassociations referring to transitory soil-ecological conditions.

4. In meadow soils with salt in depth, in the profile of which the two clay fractions are prevailing in the desiltable part, alkalinity occurs at the most in the deeper strata. Its most distributed marshland association is *Agrosti-Alopecuretum.*

In the deepest zone the two clay fractions are already forming 80 percent of the desiltable part of the soil layers, without any considerably salt content. There occur here the glycophilic species combinations of *Agrosti-Beckmannietum* demanding good water supply for the whole year. — In the same zone, as well as in the shore-zone of the lake, there is a salt marsh of alkali soil where *Bolboschoenetum maritimi continentale* is dominant.

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Acta Biologica Szeged 16 (1—2), pp. 43—50 (1970)

NEKTARIUM UND NEKTARPRODUKTION DER DIGITALIS ARTEN

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(Eingegangen am 25. April, 1969)

Der wollige Fingerhut *(Digitalis lanata Ehrh.)* ist eine selbst wild vorkommende Kulturheilpflanze. Der rote Fingerhut *(Digitalis purpurea L.)* ist eine Gartenzierpflanze. Beide sind zweijährig. Sie enthalten mehrere giftige Glykoside, die hauptsächlich in der Herzheilkunde eine wichtige Rolle spielen. Die *D. Lanata* ist eine der wichtigsten heimizchen Heilpflanzen.

Über die Nektarien, die Nektarproduktion dieser giftigen Pflanzen, ihre Bedeutung auf die Bienenzucht und über die Wirkung des Nektars auf die Bienen wissen wir wenig.

Deshalb haben wir in 1966—67 beide Arten in Gödöllő auf Kleinparzelle gezüchtet. An ihren Blumen haben wir Nektarmessungen und andere Beobachtungen zunächst für die Bienenzucht ausgeführt (L. HALMÁGYI). Aus den Nektarien desselben Pflanzenstoffs haben wir auch histologische Präparate verfertigt um festzustellen, wie gross die Konzentration des Nektars sei, den die Nektarien in Hinsicht der Bündchenversorgung produzieren können und wie die Nektarsekretion auf der sezernierenden Oberfläche stattfinde (S. GULYÁS).

Methode

Für die histologischen Untersuchungen haben wir die in 50% Äthanol präservierten Nektarien in Zelloidin eingelegt. Die von KISSER (1926) und ROMEIS (1948) beschriebene Zelloidineinbettung wurde in einer gewissermassen modifizierten Form angewendet. Aus den Nektarien haben wir Längsschnitte von einer 8—12 Dicke gemacht. Nach Entfernung des Zelloidins und der plasmatischen Bestandteile hat sich Ehrlichs Hämatoxylin- und Chrysoidin-Doppelfärbung als die Geeignetste erwiesen, die Zellwände zu färben. Die Färbung war regressiv, sukzedan.

24 Stunden vor den Nektarmessungen haben wir die für die Untersuchung bestimmten Pflanzen mit einem Tüllnetz bedeckt, damit wir die Insekten von den Blumen fernhalten. Der Nektar wurde mit der glaskapillaren Methode gewonnen. Das Trockenstoffprozent des Nektars wurde mit ZEISS-ABBE'S Refraktometer gemessen. Das Trockenstoffprozent ist als Zuckerinhalt gegeben worden. Der Zuckerwert ist die während 24 Stunden produzierte Zuckermenge einer Blume in mg. Wir haben den Nektar immer aus völlig aufgegangenen aber noch nicht welkenden Blumen genommen. Um den eventuellen Bienentod zu beobachten und auch Honig zu gewinnen, haben wir einen aus einem Siebgewebe gemachten Isolator über die *D. lanata* Parzelle gelegt. Seine Grösse war 4×2, 5×2 m. Unter den Isolator haben wir in einem kleinen Bienenstock Bienen angesiedelt.

Um die in den Gebietseinheiten ausgewählte Nektarquantität feststellen zu können, haben wir bei beiden Arten auf 100—100 Pflanzen die Blumen gezählt.

Ergebnisse

Die Nektarien befinden sich um die Grundlage des Ovariums. Auf Grund ihrer charakteristischen Struktur kann es festgestellt werden, dass sie Karpellursprungs sind. In ihrer Ausbildung nehmen die abaxialen Schichten des Dermatogens und Subdermatogens teil.

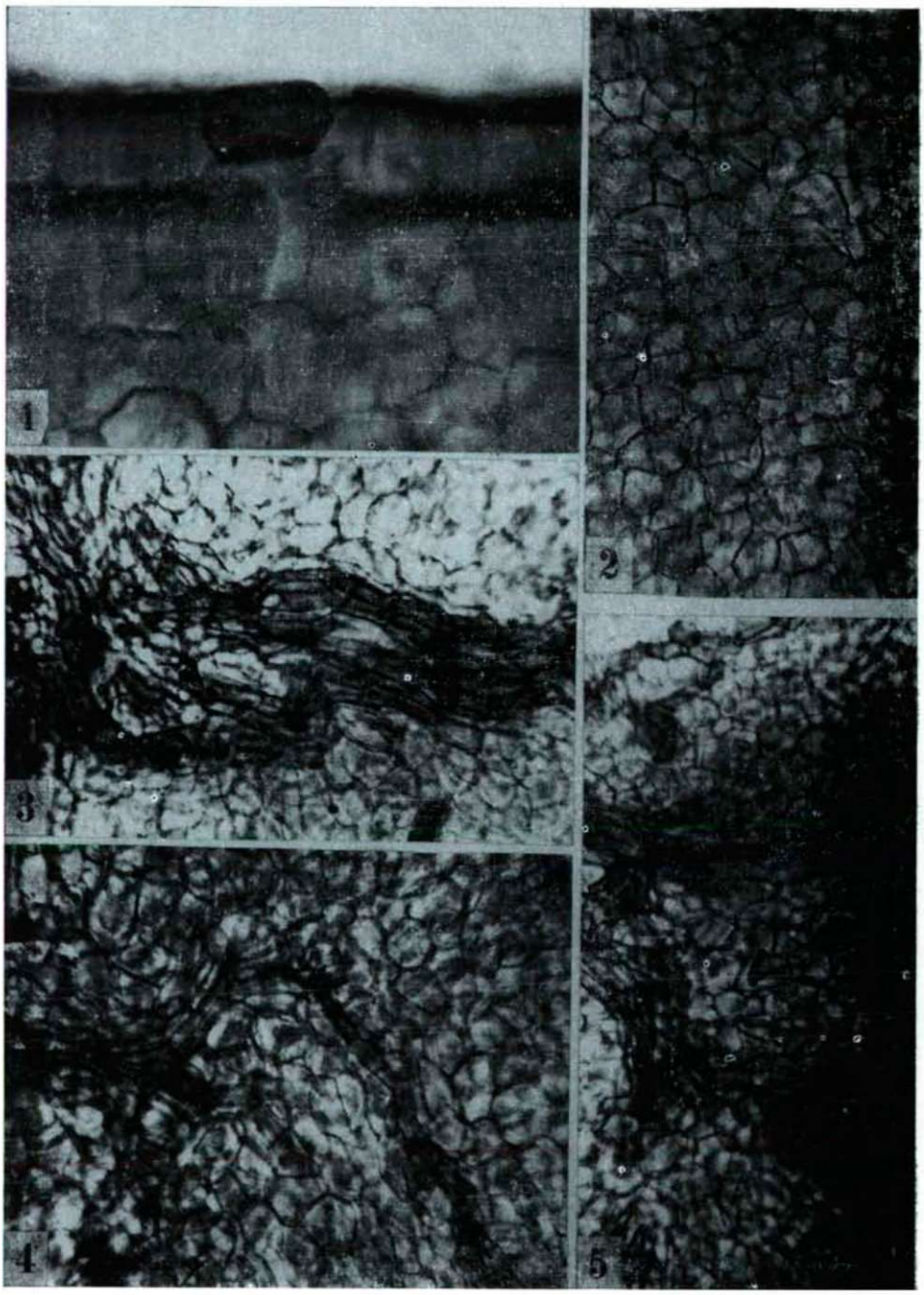
Unter den Nektarien der *D. lanata* und *D. purpurea* können hauptsächlich äussere morphologische Unterschiede beobachtet werden. Ihre Struktur stimmt hinsichtlich der wesentlichen Eigenschaften überein; sie wird in den Folgenden kurz besprochen.

Die Nektarien werden von einer dünnen Kuticula bedeckt. Unter ihr befindet sich eine Zellenreihe dicke Epidermis (Tafel I, Nr. 1). Unter den Epidermiszellen kommen auf der sezernierenden Oberfläche Nektarstomata vor. Der Nektar gerät durch diese auf die Oberfläche aus. Die Schliesszellen der Stomata stehen in einem Niveau mit den Epidermiszellen (Tafel I, Nr. 1). Auf den Nektarien können fernen von der sezernierenden Oberfläche auch Deckhaare beobachtet werden, die auf dem Samengehäuse häufig sind. Diese Deckhaare weisen gleichfalls auf den gemeinsamen Ursprung des Pistills und des Nektariums hin. Unter der stomatisierten Oberfläche kann ein polygonales, isodiametrisches, hie und da aus kleinen abgerundeten Zellen bestehendes, glanduläres Gewebe dünner Wand ohne Interzellularsubstanz beobachtet werden (Tafel I, Nr. 2). Der andere Teil des ringartigen aber ein wenig asimmetrischen Nektarisums wird mit Nektariumparenchym ausgefüllt. In diesem laufen die von der Wand des Samengehäuses ausgehenden Bastbündel (Tafel I, Nr. 3). Diese verzweigen sich im Nektariumparenchym der *D. lanata* weniger, der *D. purpurea* mehr, dann enden sie in dem glandulären Gewebe, nachdem sie das Nektariumparenchym passiert hatten (*D. purpurea:* Tafel I, Nr. 4., *D. lanata:* Tafel I, Nr. 5). Diese Feststellung ist konträr mit der auf anderen Pflanzengruppen bestimmten Feststellung von BEUTLER (1953), FREI (1955), HELDER (1958) und MAURIZIO (1960), wonach in dem Glandulärgewebe niemals Bündel laufen. Auch FREI (1955) fand Nektarien mit Bastbündeln in der *Digitalis lutea.* Auf Grund der Obigen ist festzustellen, dass die *D. lanata* und *D. purpurea* gleicherweise eine für eine konzentrierte Nektarproduktion ausgebildete Nektariumstruktur aufweisen.

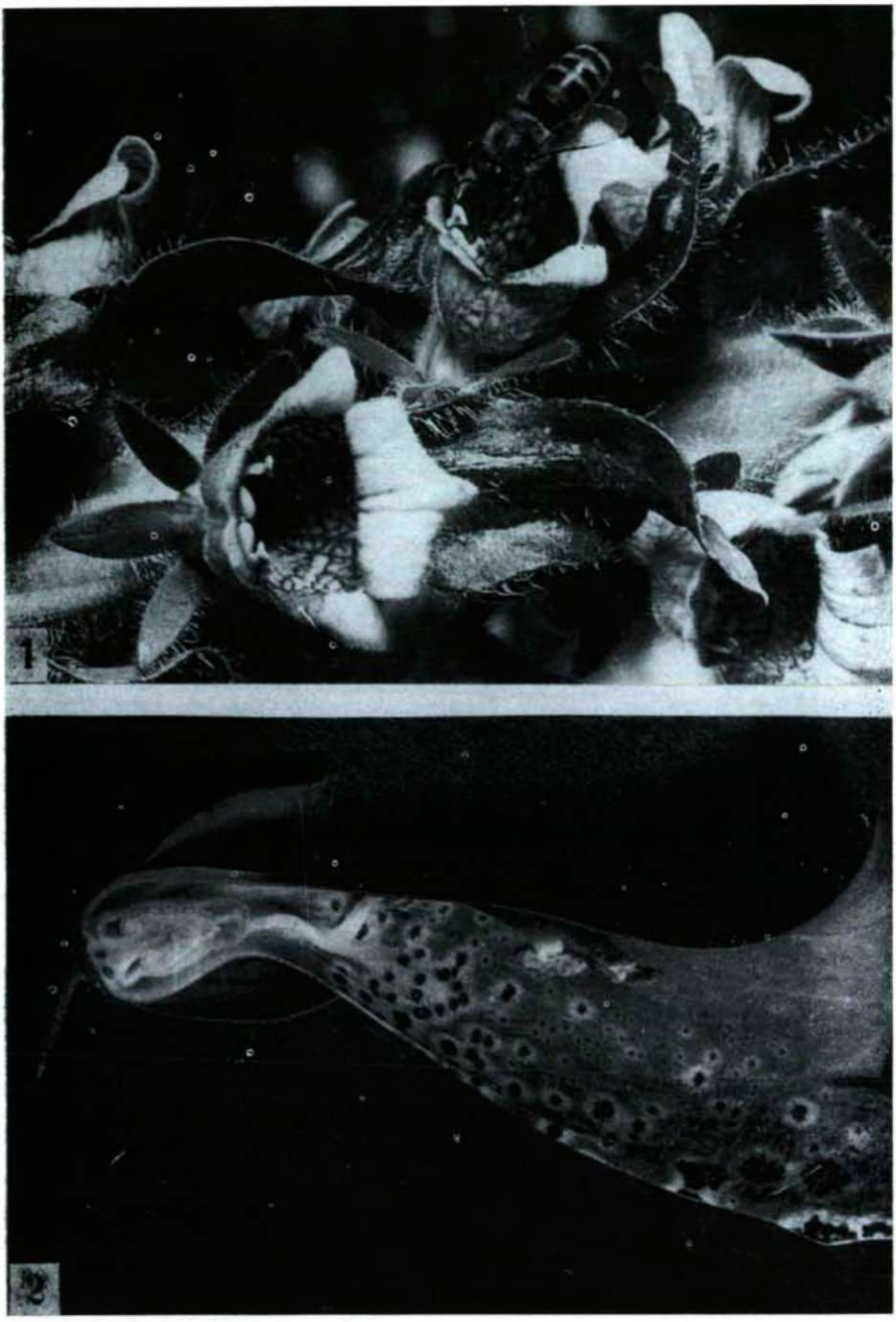
Die Ergebnisse der Nektarmessungen sind in den Tabellen I. und II. gegeben. In der Tabelle III. wurden die meteorologischen Angaben angegeben. Aus dem Vergleich ist ersichtlich dass *D. lanata* viel grösseren Schwankungen als *D. purpurea* unterliegt, was das Nektargewicht und das Zuckerprozent anbelangt. Daraus folgt es, dass bei der Voreigne auch der Honigwert schwankender ist. Der Zuckerwert änderte sich bei der *D. lanata* zwischen 0,223—6,384 mg, bei der *D. purpurea* zwischen 2,116—7,601 mg. Die Ursache der Schwankungen vermag zunächst in der Länge der Korollenröhre gesucht zu werden. Dies schwankt bei der *D. lanata* um 15 mm, bei der *D. purpurea* zwischen 40—45 mm. Innerhalb der Blume der *D. lanata* machen sich die äusseren Umstände des Wetters offensichtlich besser geltend als bei den

Tafel I. 1. *Digitalis lanata* Nektarium-Längsschnitt × 600
2. *Digitalis lanata* Nektarium-Längsschnitt × 250
3. *Digitalis lanata* Nektarium-Längsschnitt × 250
4. *Digitalis purpurea* Nektarium-Längsschnitt × 250
5. *Digitalis lanata* Nektarium-Längsschnitt × 250

Tafel I



Tafel II



Blumen der anderen Art. Über die Blumenbiologie der *Digitalis* Arten wurden Beobachtungen von Percival und MORGAN (1965) mitgeteilt.

In Gödöllő, in der ersten Woche von 1967, als die Blütezeit ihrem Ende näherte, gab es auf den Einzelpflanzen der *D. lanata* durchschnittlich 255,5 auf den der *D. purpurea* aber 98,6 Blumen. Unter Berücksichtigung der obigen Angaben haben wir eine Umrechnung durchgeführt um festzustellen, vorausgesetzt normale Witterungsverhältnisse und eine durchschnittliche Nektarproduktion, wieviel Honig die Bienen von einem Hektar der *Digitalis*kultur abbringen.

GIOVANNINI und SZATHMÁRY (1961) nach sind für die *D. lanata* und *D. purpurea* Produktion in einem Katastraljoch gleicherweise ung. 30.000 Pflänzlinge nötig. Man kann deshalb in einem Hektar mit 52.350 Pflanzen rechnen. Bei der *D. lanata* 255, bei der *D. purpurea* 100 Blumen für eine Pflanze rechnend, können sich in einem Hektar 13,349.250 *D. lanata* und 5,235.000 *D. purpurea* Blumen entwickeln. Bei der *D. lanata* haben wir 1,5 mg, bei der *D. purpurea* 4,0 mg Zuckerwert gerechnet. In diesem Fall, annehmend bei beiden Arten Honig von 80% Zuckerinhalt, können die Bienen in einem Hektar täglich 24—25 kg Honig sammeln. Es kann natürlich grosse Abweichungen davon geben, diese Angaben sind nur Informationscharakters.

Die Blumen beider untersuchten *Digitalis* Arten wurden von den Bienen beflogen (Tafel II, Nr. 1). Es ist wahr, dass in der Umgebung in der Zeit der Untersuchungen keine bedeutenderen nektarproduzierenden Pflanzen geblüht haben. Unseren Beobachtungen nach kommen die Bienen dem Nektarium der *D. purpurea* schwierig an. Das Innere der Korollenröhre (Tafel II, Nr. 2) ist nämlich der dicken Kutikule zufolge für die Bienen rutschig. Dessenungeachtet erreichen beinahe alle Bienen die Staubgefässe oder den Nektar in kürzerer oder längerer Zeit und nur verschwindend kleine Anzahl von ihnen fliegen ohne Nährstoff davon. Bei dieser Art erreichen auch nach PELLETT (1947) die Bienen nur schwierig den Nektar. Der Nektar der *D. lanata* wurde hingegen von den Bienen ohne Schwierigkeit abgebracht.

KUTIAK und WOHANKA (1965) referieren davon, dass in Habersfeld (Österreich) die Bienen gewöhnt wurden, die Blumen der *D. lanata,* die auf einem halben Hektar für ihre Samen gezüchtet worden waren, zu befliegen. Die Familien wurden mit Sirup gefüttert, in welchem die Blumen der *D. lanata* gekocht waren. Während die Bestaubung früher hauptsächlich von Hummeln ausgeführt wurde, hat man jetzt einen reichen Bienengang beobachtet. Die erwähnten Verfasser schreiben nicht darüber, wie das Bienenfeld während der Untersuchungen in der Umgebung war. PERCIVAL und MORGAN (1965) schreiben in Verbindung mit den *Digitalis* Arten über ein häufiges Befliegen der Hummeln und ein gelegentliches Befliegen der Honigsammelnden Bienen. In Gödöllő haben in erster Reihe die Honig-sammelnden Bienen die Blumen ohne irgendeine Aneiferung und Gewöhnung beflogen. Hier soll erwähnt werden, laut Bericht von GRAFL (1949), dass in der Schweiz die Blumen des in den Gärten als Zierpflanze gezüchteten *Digitalis ferruginum* von den Bienen den ganzen Sommer lang beflogen werden. Dem Verfasser nach wird die Pflanze schon in der alten Fachliteratur als eine besonders gute Tracht sichernde Pflanze besprochen. (Bei uns lebt diese Pflanze wild in dem süd-östlichen Teil des Transdanubiens).

Es wird noch die Frage aufgeworfen, ob keine Glykoside in den Nektar oder in den Pollen geraten. Wenn ja, ob sie den Bienen oder in der Form des Honigs

Tafel II. 1. *Digitalis lanata* Blumen × 2
2. *Digitalis purpurea* Blumen-Längsschnitt × 2,5

dem Menschen nicht schädlich seien. KÁDÁR (1922) schreibt unter anderen die Folgenden: "Einige Giftpflanzen werden von den Bienen instinktmässig vermieder..., von anderen (... von dem roten Fingerhut) bringen sie aber störungslos, ohne dass es für sie schädlich wäre oder dass wir eine schädliche Wirkung des so gesammelten Honigs erfahren hätten." In Gödöllő, in 1944, hat man nach dem Essen des Honigs der *D. lanata* gar keine schädliche Wirkung erfahren. Der Honig kam von dem Gut des Professors J. TUZSON in Hatvan (ÖRÖSI, 1965). MUCK (1936) hat über massenhaftes Sterben von Bienen nach Befliegen des Fingerhutes berichtet. Nach Dreher jedoch (zitiert von BORCHERT, 1966) dürfte das Befliegen der Fingerhüte für de Bienen unschädlich sein. Im Fall Kutiaka und WOHANKAS (1965) schon erwähnter Untersuchung hat die Analyse in dem gesammelten Honig geringer Menge keine *Digitalis* Glykoside erwiesen. Das die Fingerhüte befliegende Bienenvolk hat gar keine Schädigung aufgezeigt, ja dieses Bienenvolk überwinterte sogar mit auffällig wenigem Bienentod. Nach PELLETT (1947) tragen die Bienen in Britisch-Kolumbien (Kanada) den Nektar der *D. purpurea* ohne irgendeine schädliche Wirkung. Muck steht also allein mit seiner Beobachtung in der bisherigen Fachliteratur.

Tabelle I. Nektarmessungsangaben: *Digitalis lanata*

Datum	Stunde	Anzahl der untersuchten Blumen	Nektar		
			Durchschnittsgewicht mg	Zuckerprozent	Zuckerwert
7. VI.	9	8	0,45	49,6	0,223
	14	7	10,64	60,0	6,384
8. VI.	9	10	0,53	70,0	0,371
	14	19	2,58	61,4	1,584
9. VI.	9	10	1,74	30,6	0,532
	14	18	2,19	29,0	0,635
10. VI.	9	10	4,25	21,0	0,892
	14	12	1,86	20,8	0,386
14. VI.	9	12	3,13	31,0	0,970
	14	13	1,27	41,5	0,527
21. VI.	9	15	1,15	62,8	0,722
	14	23	5,80	43,9	2,546
22. VI.	9	20	3,33	62,0	2,064
	14	26	2,56	65,0	1,664

In Gödöllő, in 1967, konnten wir mit Hilfe eines Isolators eine kleine Menge von *D. lanata*-Honig gewinnen. Der Honig ist hell gelb, schmackhaft. Nach einer Zeit haben sich aus ihm wenige weisse Kristalle ausgesondert. Diese sind so klein, dass der Honig auch weiterhin flüssig geblieben ist. Das unter den Isolator gelegte kleine Bienenvolk konnte ungefähr zwei Wochen lang nur die Blumen der *D. lanata* befliegen, ohne dass auf den Bienen irgendeine Schädigung beobachtet werden konnte.

Nach den Untersuchungen von PERCIVAL (1961) enthält der Nektar der *D. lanata* Glukose, Fruktose und Sacharose; im Nektar der *D. purpurea* kommt ausserdem auch Raffinose vor.

Auf Grund unserer Untersuchungen halten wir die Arten *D. lanata* und *D. purpurea* für gute Honig machende Arten.

Tabelle II. Nektarmessungsangaben: *Digitalis purpurea*

Datum	Stunde	Anzahl der untersuchten Blumen	Nektar		
			Durchschnittsgewicht mg	Zuckerprozent	Zuckerwert
6. VI.	9	10	12,44	40,1	4,988
7. VI.	9	7	6,17	34,3	2,116
	14	8	6,80	40,5	2,754
8. VI.	9	7	7,44	39,1	2,909
	14	16	9,97	45,6	4,546
9. VI.	9	15	11,64	34,0	3,957
	14	20	13,89	33,0	4,583
10. VI.	9	15	31,41	24,2	7,601
	14	12	20,32	25,0	5,080
14. VI.	9	16	11,73	30,0	3,519
	14	12	16,28	27,9	4,542
21. VI.	9	17	13,82	33,2	4,588
	14	16	18,76	28,5	5,326
22. VI.	9	19	13,76	31,4	4,320
	14	22	11,87	31,7	3,762

Tabelle III. Meteorologische Angaben (Gödöllő, 1967)

Datum	Stunde	Temperatur °C	Tagestemperatur		Relative Luftfeuchte %	Niederschlag mm
			maximum °C	minimum °C		
6. VI.	7	13,9	22,5	11,6	11,2	—
	13	21,2			13,4	
7. VI.	7	16,0	25,0	10,0	11,4	—
	13	23,8			16,6	
8. VI.	7	18,4	27,0	15,8	14,4	2,0
	13	26,2			20,4	
9. VI.	7	16,6	23,0	15,5	15,8	23,5
	13	17,4			15,0	
10. VI.	7	13,3	17,5	12,7	13,0	24,5
	13	15,2			14,8	
14. VI.	7	10,0	18,0	8,6	9,6	Tauspuren
	13	17,4			10,8	
21. VI.	7	17,8	25,0	14,5	15,6	0,9
	13	24,2			17,5	
22. VI.	7	16,0	22,5	13,4	12,4	—
	13	21,4			13,0	

Zusammenfassung

Die Nektariumstruktur, die Nektarproduktion und die Bedeutung für Bienenzucht der *D. lanata* und *D. purpurea* können kurz in den Folgenden zusammengefasst werden:

1. Das Nektarium der untersuchten Arten hat eine Struktur, die für eine konzentrierte Nektarproduktion geeignet ist.

2. Der Zuckerwert der *D. lanata* änderte sich zwischen 0,22—6,38 mg, der der *D. purpurea* zwischen 2,11—7,60 mg.

3. Unter Berücksichtigung der durchschnittlichen Blumenzahl der Individuen und des Zuckerwertes der Blumen, können die Bienen von den Kulturen der *D. purpurea* und *D. lanata* täglich in einem Hektar 24—25 kg Honig sammeln.

4. Nach Befliegen des Fingerhutes hat man bei den Bienen keine Schädigung erfahren.

Die untersuchten *Digitalis* Arten wurden von dem Heilpflanzenuntersuchenden Institut (Budapest) erhalten, aus einer Substanz englischen Ursprungs. Für die Überlassung der Pflanzen und für seine wertvollen Ratschläge sprechen wir unseren Dank dem Herrn wissenschaftlichen Abteilungsleiter i. R. G. SZATHMÁRY auch in diesem Wg. aus.

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Acta Biologica Szeged 16 (1—2), pp. 51—54 (1970)

SPORE-POLLEN INVESTIGATIONS ON THE PALEOCENE SEDIMENTS OF OICHING

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(Received November 20, 1968)

Introduction

A knowledge of the spore-pollen assemblage of the sediments of Palaeocene age is of great importance for appraising the spore-pollen assemblages, of the Tertiary period and, in connection with them, the development of the Tertiary flora of modern character, from the point of view of evolution. In this respect, the Danian and Monsian stages are particularly important. About the spore-pollen composition of the localities of these stages there wasn't, unfortunately, published anything, so far; and even, on the basis of the observations till now, the stratum typicum of the Danian stage does not contain any sporomorphs (KEDVES, 1967a). In addition to them, also the sporomorph data of the lower Palaeocene sediments of the other localities are worth while being studied as relatively few documentations are known about that period. That made me publish in a short paper the palynological observations on the Palaeocene sediments of Oiching.

Materials and Methods

The samples investigated have been collected by Mrs. Báldi. The material has been placed at my disposal at first hand by DR. TIBOR KECSKEMÉTI. I am deeply indebted to him for his kind support. A lot of samples were investigated from the Danian, Monsian and Thanetian stages. From the material at my disposal, the Monsian sample has given, so far, sporomorphs of enough quantity. The aim of the present publication is first of all to draw attention to a further systematic palynological investigation of these localities. Therefore, I am publishing here but a partial documentation about the sporomorphs observed.

Results

1. From the Pteridophyte spores the following taxons have occurred: *Schizaeaceae*, cf. *Lygodium* — *Leiotriletes dorogensis* (KDS. 1960) KDS. 1961 —, *Anemia* — *Cicatricosisporites dorogensis* (R. POT. and GELL., 1933) KDS. 1961 subfsp. *minor Kds.* 1961 fvar. *triplan* KDS. 1961, *Cicatricosisporites* fsp., *Schizaeacaee* v. *Gleicheniaceae* — *Triplanosporites* cf. *sinuosus* PF. 1953, *Schizaeaceae* — *Trilites* fsp., *Pteri-*

daceae — Polypodiaceoisporites fsp.$_{1-2}$, *Polypodiaceae — Laevigatosporites* fsp., *Osmundaceae — Baculatisporites* fsp., *Selaginellaceae — Echinatisporis* fsp. The following spores are unknown in view of their nearer botanical affinities: *Leiotriletes* fsp.$_{1-2}$, *Triletes* fgen. et fsp. indet.

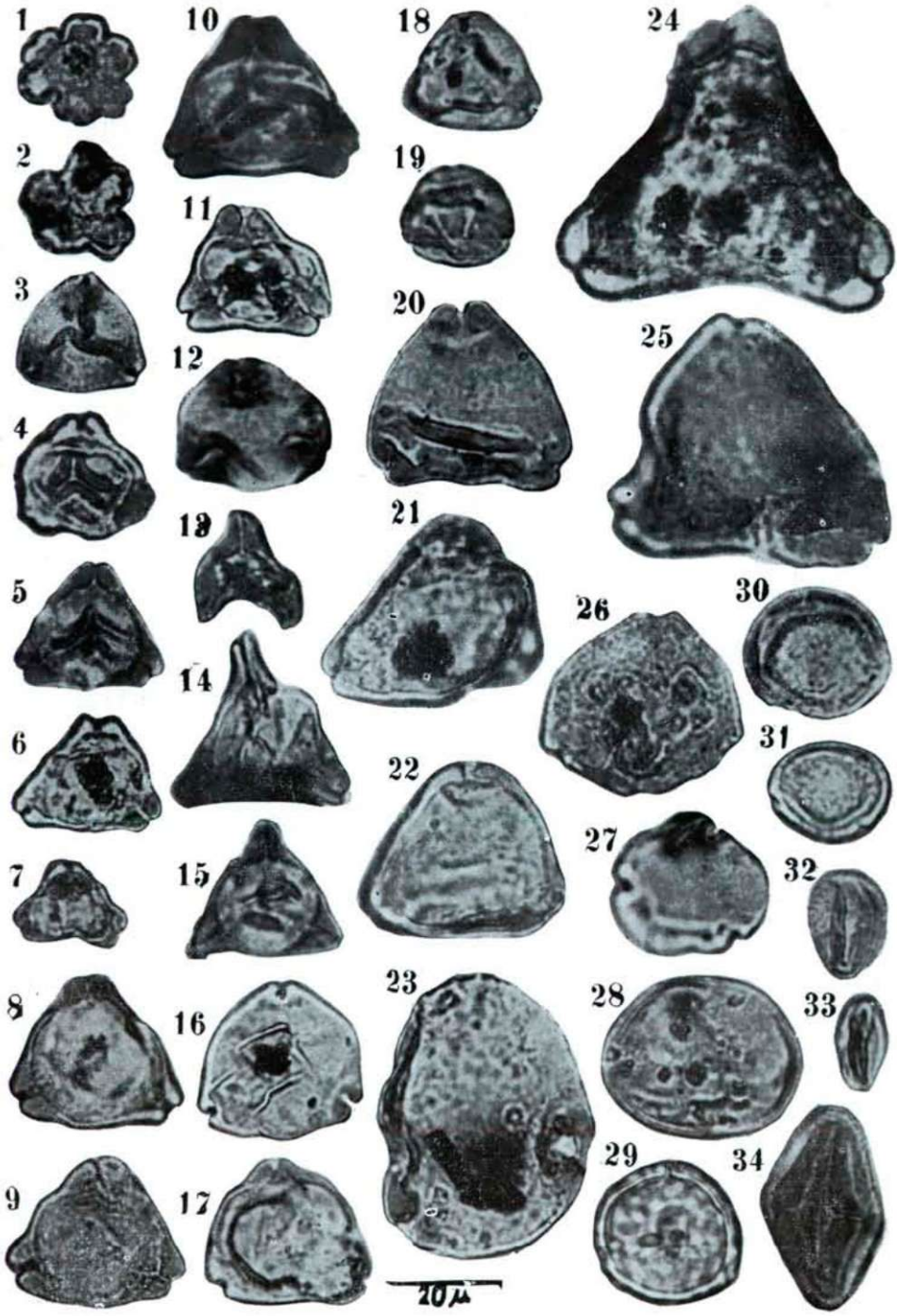
2. The *Gymnospermatophytae* are represented by pollen grains of *Pinus haploxylon* type, the *Ephedraceae* by another pollen type — *Ephedripites (Ephedripites)* fsp.

3. From the point of view of the age determination, the most important ones are the *Angiospermatophyte* pollens of which the following may be accentuated: *Stephanoporopollenites hexaradiatus* (THG. 1940) TH. and PF. 1953 subfsp. *hexaradiatus* (Plate I, 1), *Stephanoporopollenites pentaradiatus* W. KR. 1961 (Plate I, 2), cf. *Sporopollis* aut *Plicapollis* fsp. (Plate I, 3) *Plicapollis* fsp. ex group *pseudoexcelsus* (Plate I, 4), *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *turgidus* PF. 1953 (Plate I, 5, 6), *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *minor* Pf. 1953. (Plate I, 7) *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *semiturgidus* PF. 1953 (Plate I, 8, 9), *Plicapollis* fsp. (Plate I, 10), *Trudopollis*

Plate I

Fig. 1. *Stephanoporopollenites hexaradiatus* (Thg. 1940) TH. and PF. 1953 subfsp. *hexaradiatus*.
Fig. 2. *Stephanoporopollenites pentaradiatus* W. KR. 1961.
Fig. 3. Cf. *Sporopollis* aut *Plicapollis* fsp.
Fig. 4. *Plicapollis* fsp. ex group *pseudoexcelsus*.
Fig. 5. *Plicapollis pseudoxcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *turgidus* PF. 1953.
Fig. 6. *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *turgidus* PF. 1953.
Fig. 7. *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *minor* PF. 1953.
Fig. 8. *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *semiturgidus* PF. 1953.
Fig. 9. *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *semiturgidus* PF. 1953.
Fig. 10. *Plicapollis* fsp.
Fig. 11. *Trudopollis* fsp.
Fig. 12. *Oculopollis* fsp.
Fig. 13. Cf. *Nudopollis* fsp.
Fig. 14. *Nudopollis endangulatus* (PF. 1953a) PF. 1953b.
Fig. 15. *Nudopollis terminalis* (PF. and TH 1953) subfsp. *hastaformis* PF. 1953a.
Fig. 16. *Triatriopollenites* fsp.$_1$.
Fig. 17. *Triatriopollenites* fsp.$_1$.
Fig. 18. *Triatriopollenites* fsp.$_2$.
Fig. 19. Cf. *Platycarya*.
Fig. 20. *Triatriopollenites roboratus* PF. 1953a.
Fig. 21. *Triatriopollenites roboratus* PF. 1953a.
Fig. 22. *Triatriopollenites* fsp. $_3$.
Fig. 23. *Triatriopollenites roboratus* PF. 1953a.
Fig. 24. *Triatriopollenites pseudovestibulum* PF. 1953a.
Fig. 25. *Triatriopollenites aroboratus* PF. 1953a.
Fig. 26. *Triporopollenites robustus* PF. 1953a.
Fig. 27. *Intratriporopollenites* cf. *ceciliensis* W. KR. 1961.
Fig. 28. *Caryopollenites* cf. *circulus* (PF. 1953a) W. KR. 1961.
Fig. 29. *Triporopollenites* cf. *vadosus* PF. 1953a.
Fig. 30. *Subtriporopollenites constans* PF. 1953a. subfsp. *constans*.
Fig. 31. *Subtriporopollenites constans* PF 1953a subfsp. *constans*.
Fig. 32. *Tricolporopollenites* fsp.$_1$.
Fig. 33. *Tricolporopollenites* cf. *oviformis* (R. POT. 1931).
Fig. 34. *Tricolporopollenites* fsp.$_2$.

Plate I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fsp. (Plate I, 11), *Oculopollis* fsp. (Plate I, 12), cf. *Nudopollis* fsp. (Plate I, 13), *Nudopollis endangulatus* (Pf. 1953a) Pf. 1953b (Plate I, 14), *Nudopollis terminalis* (Pf. and Th. 1953) Pf. 1953b subfsp. *hastaformis* Pf. 1953a (Plate I, 15), *Triatriopollenites* fsp.$_1$ (Plate I, 16, 17), *Triatriopollenites* fsp.$_2$ (Plate I, 18), cf. *Platycarya* (Plate I, 19), *Triatriopollenites roboratus* Pf. 1953a (Plate I, 20, 21, 23), *Triatriopollenites* fsp.$_3$ (Plate I, 22), *Triatriopollenites pseudovestibulum* Pf. 5953a (Plate I, 24), *Triatriopollenites aroboratus* Pf. 1953a (Plate I, 25), *Triporopollenites robustus* Pf. 1953a (Plate I, 26), *Intratriporopollenites* cf. *ceciliensis* W. Kr. 1961 (Plate I, 27), *Caryapollenites* cf. *circulus* (Pf. 1953) W. Kr. 1961 (Plate I, 28), *Triporopollenites* cf. *vadosus* Pf. 1953a (Plate I, 29), *Subtriporopollenites constans* Pf 1953 a subfsp. *constans* (Plate I, 30, 31), *Tricolporopollenites* cf. *oviformis* (R. Pot. 5931) (Plate I, 33), *Tricolporopollenites* fsp.$_{1-2}$ (Plate I, 32, 34).

Discussion of results

From the sporomorphs published, the occurrence of genus Stephanoporopollenites has a particular importance as regards the determination of age, first of all at "old palaeocene" species that are different e. g. from those observed in the spore—pollen assemblage belonging to the Thanetian stage of Menat (Kedves 1967b). From this point of view, *Triatriopollenites pseudovestibulum* is to be emphasized, too, described on the basis of Wehmigen's Danian sediments or of the Palaeocene period.

Summary

We have carried out investigations on Oiching's Danian, Monsian and Thanetian sediments. From the samples observed, we have succeeded in observing sporomorphs belonging to the Monsian stage. Although the samples contained but a low number of forms that were, here and there, damaged, too, we could demonstrate in the spore-pollen assemblage the most important types that are characteristic of the lower Palaeocene sediments.

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Acta Biologica Szeged 16 (1—2), pp. 55—68 (1970)

SPORE-POLLEN DATA FROM THE MARL LAYERS OF MTE. BOLCA

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Introduction

The marl layers of Mte. Bolca has become renowned owing to its faunal remainders in an excellent state. On the basis of literary data, however, the opinions concerning its geological age are different.

On the comparative stratigraphical table of the spore-pollen types known from the locality types of the Paris basin, as well from the major European localities of the lower palaegenic age, the upper level of the Cuisian sub-stage is taking place with the data of the locality type (KEDVES, 1967). On the basis of the classic data of the upper level of the sub-stage Sparnacian, and of the data, from Cuise mentioned above, more layers in Hungary from the lower Eocene (Halimba, Iszkaszentgxörgy) belong probably to the lower level of the Cuisian sub-stage.

It is generally known that in the upper Cretaceous and Palaeogene periods the living world of Hungary was in a close connection with the Mediterranean region. It is, therefore, very considerable from the point of view of the pollen stratigraphy of the lower Eocene layers in Hungary, as well, to know the composition of the sporomorhae in the layers of Mte. Bolca.

About the sporomorphae of the Mediterranean Palaeogene sediments we have got so long but a few data. It is an open question so far, in which degree the pollen-stratigraphic regularities, recorded in Central, Western and Eastern Europe till now, are valid for this area. Thus the palaeogene pollen-stratigraphy of Europe, resp. its connections of general validity can be promoted with knowledge of these data.

Materials and Methods

The matter of our investigations has been made available for us by TIBOR KECSKEMÉTI who collected it with ENDRE DUDICH, JR. and GÁBOR KOPEK together. We wish to express our thanks in this way, as well, for their kind help.

The preparation of the rock samples took place with a treatement with HCl and fluorhydrogen.

Our preparations are relatively poor in spores and pollen grains; on the other hand, in remains of Hystrichosphaeridae they are extremely rich. For obtaining a sporomorpha ensemble that was suitable to be compared we had to investigate 55 preparations.

Problems of terminology

The taxonomy and the science of terminology of the sporomorhae of the lower Tertiary period have been advancing with rapid strides in recent times, although we are still far from a general unitary science of terms. The great number of papers published of late years have resulted in a lot of synonyms, as well.

Below we shall exclusively treat of some questions in connection with our data, in accordance with the degree of their importance.

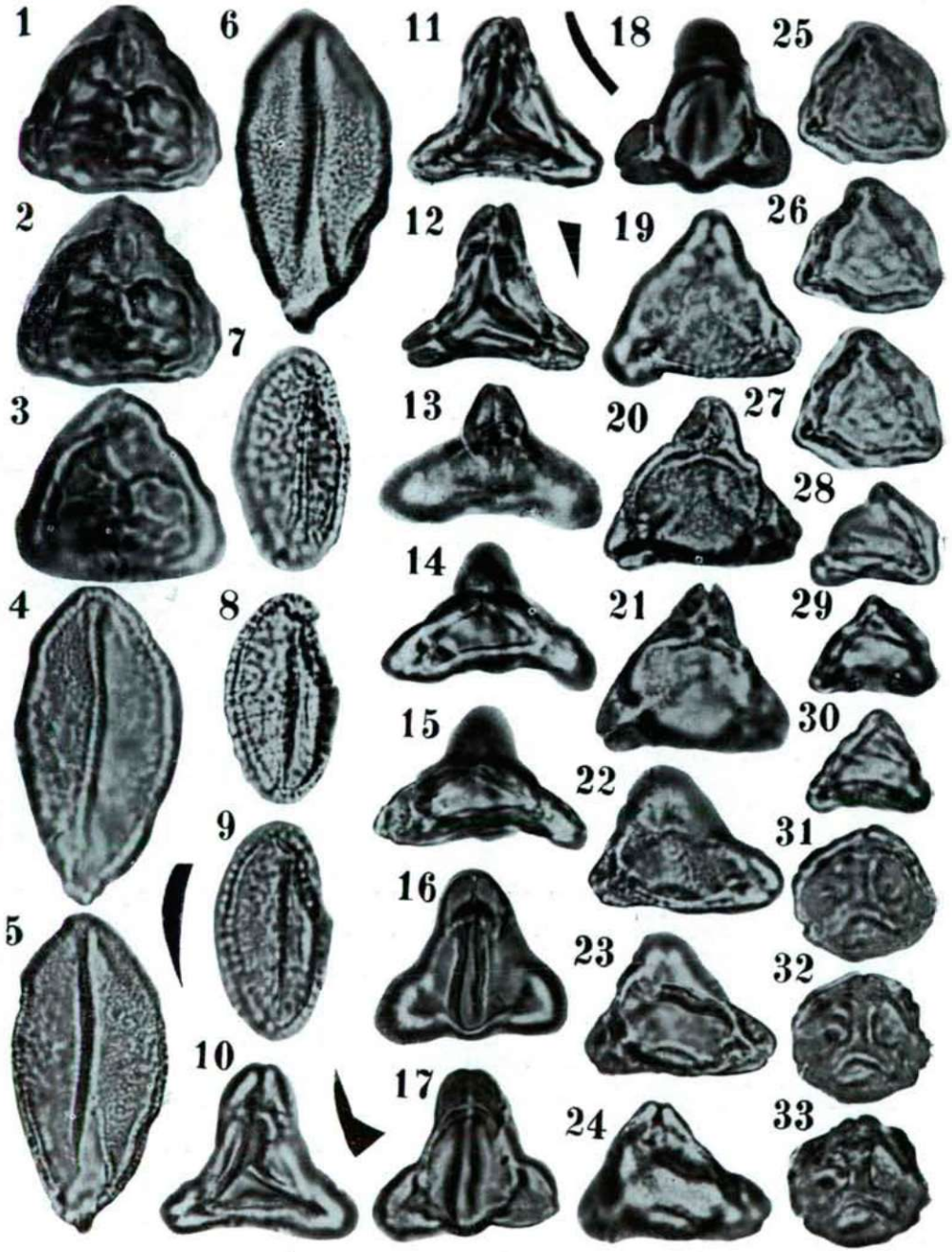
1. In the Hungarian special literature a pollen type Restionaceae, that is very important from palaeobotanical point of view, was described by the name *Monoporopollenites hungaricus* KDS. 1965. (Plate IV, 4—6). The fossil pollen grains of the type Restionaceae were classified by KRUTZSCH (1961) into genus *Milfordia* ERDTMAN 1960, and the *Inaperturopollenites incertus* PF. & TH. 1953 subfsp. *foveolatus* PF. & TH. 1953 published by THOMSON & PFLUG (1953), were published by him by the name *Milfordia incerta* (TH. & PF. 1953) W. KR. 1961. On the other hand, ERDTMAN's (1960) genus diagnosis is: "Generic diagnosis (genotype *Milfordia hypolaenoides*): Pollen grains monocolpate. Colpus with slightly jagged margin. Exine psilate, its outer layer (sexine) provided with small, densely spaced circular pits (scrobiculi)." Although there can be found doubtless a great similarity between the structures of *Milfordia hypolaenoides* ERDTMAN 1960 and *Monporopollenites hungaricus* KDS. 1965 exine, nevertheless, they cannot belong to an identical genus as genus *Milfordia Erdtman* 1960 is containing monocolpate forms, the mentioned pollen grains of the type *Restionaceae,* however, monoporate ones. The use of genus *Milfordia* ERDTMAN 1960 is reflected also by ROCHE's work (1968) where the terms *Milfordia incerta* KRUTZSCH 1960 and *Milfordia hungarica* (KEDVES, 1965) W. KRUTZSCH (manuscript) are used. After W. KRUTZSCH's personal information he wrote:

Milfordia incerta (PF. & TH. 1953) W. KR. 1961 is synonymous with:
Inaperturopollenites incertus foveolatus PF. & TH. 1953,
Milfordia hypolaenoides ERDTMAN 1960, and *Milfordia hungarica* (KEDVES, 1965) W. KRUTZSCH (manuscript) with:
Inapeturopollenites incertus PF. & TH. 1953 subfsp. *fossulatus* PF. & TH. 1953,
Monoporopollenites hungaricus KEDVES 1965,
Monulcopollenites confossus, STOWER, ELSIK & FAIRCHILD, 1966 (recte: *Monulcipollenites confossus* FAIRCHILD 1966 — in STOWER, ELSIK & FAIRCHILD 1966).

Plate I

1—3. — *Polypodiaceoisporites* fsp., *Pteridaceae, Pteris;* prep. 0—33—46, 4,8/104,7.
4—6. — *Sabalpollenites* fsp., *Palmae,* cf. *Sabal;* prep. 0—33—40, 6,3/105,8.
7—9. — *Sabalpollenites areolatus* (R. POT. 1934b) R. POT. 1958. *Palmae,* cf. *Trachycarpus;* prep. 0—33—39, 16,2/108,8.
10—12. — Cf. *Pseudoplicapollis* fsp.,; prep. 0—33—45, 6,1/107,5.
13—15. — *Basopollis* fsp.$_1$; prep. 0—33—40, 15,0/109,8.
16—18. — *Cf. Basopollis* fsp.; prep. 0—33—41, 21,9/105,2.
19—21. — *Basopollis* fsp.$_2$; prep. 0—33—54, 12,6/103,5.
22—24. — *Basopollis* fsp.$_2$; prep. 0—33—53, 13,0/107,1.
25—27. — *Interpollis supplingensis* (PF. 1953a) W. KR. 1961; prep. 0—33—53, 19,1/112,2.
28—30. — *Interpollis microsupplingensis* W. KR. 1961; prep. 0—33—48, 15,1/111,8.
31—33. — Cf. *Pompeckjoidaepollenites* fsp.; prep. 0—33—38, 13,5/114,6.

Plate I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As for the pollen grains of *Gramineae* type the genus *Graminidites* COOKSON 1947, and for the monoporate forms of reticulate sculpture genus THIERGART (1937) *Sparganiaceaepollenites* are accepted, MEYER's (1956) *Monoporopollenites* genus is invalid. On the other hand, genus *Milfordia* ERDTMAN 1960 is to be reserved to the monocolpate forms, so much more because we don't know, so far, any publication concerning a repeated investigation of the original slides and an emendation of the diagnosis. Thus the genus ELSIK 1968, that is valid for the pollen grains of the "*Restionaceae* type" is as follows Fgen.: *Restioniidites* ELSIK 1968. Type Species: *Restioniidites hungaricus* (KEDVES, 1965) ELSIK (1968).

2. The so-called *Longaxones* pollen grains are extremely problematical from the point of view of a taxonomic and botanical affinity and from the nomenclature, as well. A considerable part of the names applied in the present work must be considered, therefore, to be of provisory character. The extremely great lot of form-species described so far is expecting to be systematized. That, however, cannot be a topic of this paper of ours.

3. In exceptional cases, we use also taxons not published in details, as yet. These names are distinguished by asterisks.

Results

1. *Pteridophyte* spores have occurred but in a minimal amount (*Polypodiaceoisporites* fsp., *Pteridaceae*, *Pteris* — Plate I, 1—3).

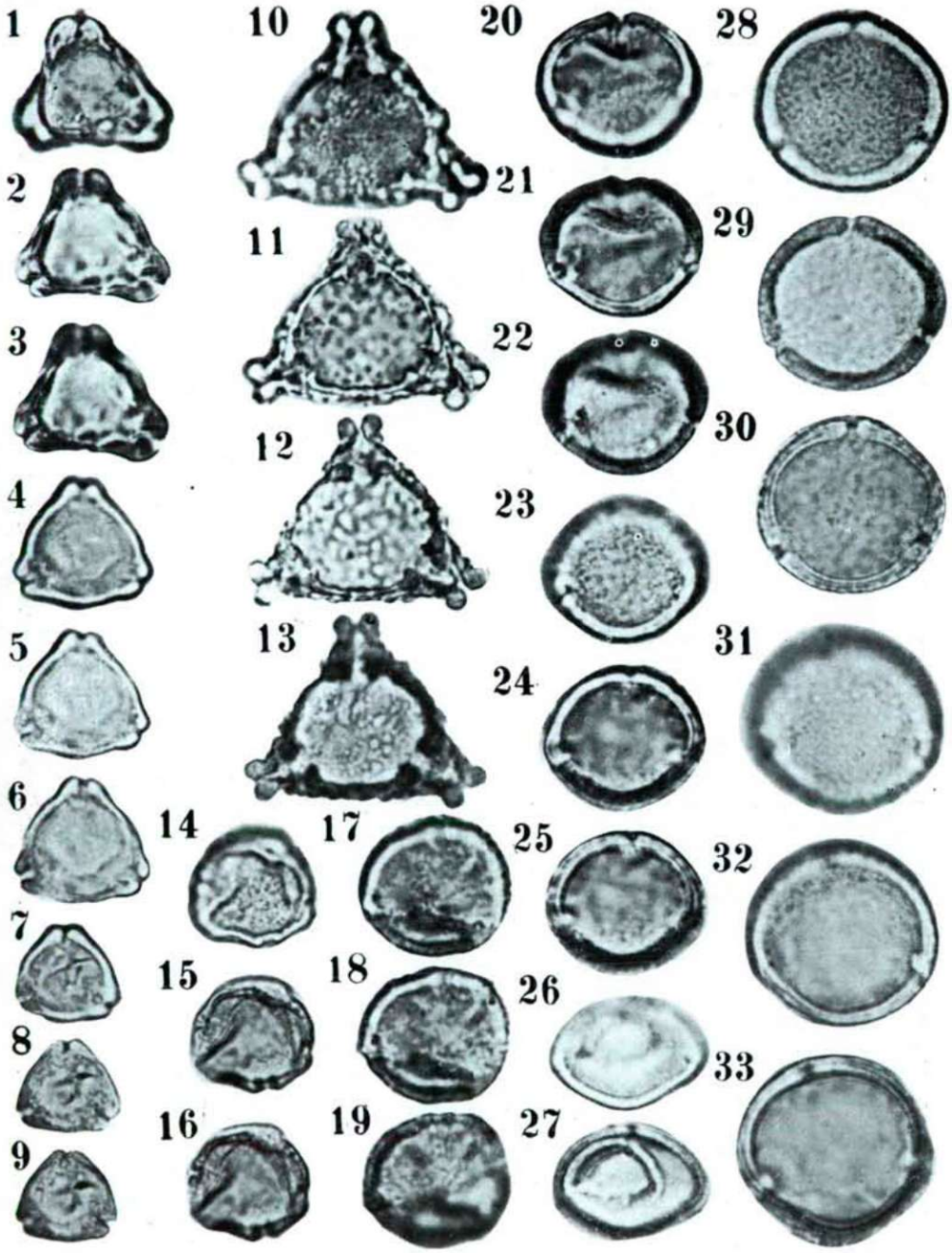
2. *Gymnospermatophyte* pollen grains could not be observed.

3. From the point of view of the geological age, the presence of representatives of the *Normapolles* stemma is particularly important (Cf. *Pseudoplicapollis* fsp. — Plate I, 10—12; *Basopollis* fsp.$_1$ — Plate I, 13—15; *Basopollis* fsp.$_2$ — Plate I, 19—24; Cf. Basopollis fsp. — Plate I, 16—18; *Interpollis supplingensis* (Pf. 1953a) W. KR. 1961 — Plate I, 25—67; *Interpollis microsupplingensis* W. KR. 1961— Plate I, 28—30; cf. *Pompeckjoidaepollenites* fsp. — Plate I, 31—33; *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *luteticus* KDS. 1968 — Plate II, 4—6; *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *minor* PF. 1953a — Plate II, 7—9. Also a new genus that is interesting in view of its morphology has

Plate II

1—3. — *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *turgidus* PF. 1953a; prep. 0—33—39, 20,8/116,8.
4—6. —* *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *luteticus* KDS. 1968; prep. 0—33—48, 11,9/106,7.
7—9. — *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *minor* PF. 1953a; prep. 0—33—19, 16,5/110,9.
10—13. — *Normapolles* fgen. et fsp. indet.; prep. 0—33—45, 21,4/104,3.
14—16. — *Triporopollenites* fsp., cf. *Betulaceae;* prep. 0—33—40, 16,3/110,8.
17—19. — *Subtriporopollenites constans* PF. 1953a subsfp. *constans, Juglandaceae*, cf. *Carya;* prep 0—33—40, 10,0/110,6.
20—22. — *Subtriporopollenites anulatus* TH. et PF. 1953 subfsp. *nanus* Th. et Pf. 1953, *Juglandaceae*, cf. *Carya;* prep. 0—33—41, 20,3/111,5.
23—25. — *Subtriporopollenites* cf. *anulatus* TH. et PF. 1953 subfsp. *nanus* TH. et PF. 1953, *Juglandaceae*, cf. *Carya;* prep. 0—33—20, 17,1/111,3.
26—27. — *Subtriporopollenites anulatus* TH. et PF. 1953 subfsp. *nanus* TH. et PF. 1953, *Juglandaceae*, cf. *Carya;* prep. 0—33—43, 11,5/109,1.
28—30. — *Subtriporopollenites* fsp., cf. *Juglandaceae, Carya;* prep. 0—33—42, 6,0/105,9.
31—33. — *Subtriporopollenites magnoporatus* (TH. et PF. 1953) W. KR. 1961, cf. *Juglandaceae, Carya;* prep. 0—33—42, 8,9/107,9.

Plate II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been found (Plate II, 10—13) occuring, however, only in one specimen; its description will therefore be possible only after getting new data.

Also the species of genus *Subtriporopollenites* occurring in a great quantity are important from this point of view (*Subtriporopollenites constans* PF. 1953a subfsp. *constans* — Plate II, 17—19, *Juglandaceae* cf. *Carya*; *Subtriporopollenites anulatus* TH. & PF. 1953 subfsp. *nanus* Th. & PF. 1953, *Juglandaceae*, cf. *Carya* — Plate II, 20—22, 26, 27; *Subtriporopollenites* cf. *anulatus* TH. & PF. 1953 subfsp. *nanus* TH. & PF. 1953, *Juglandaceae*, cf. *Carya* — Plate II, 23—25; *Subtriporopollenites magnoporatus* (TH. & PF. 1953) W. KR. 1961, cf. *Juglandaceae, Carya* — Plate II, 31—33; *Subtriporopollenites facilis* (BOTSCHARNIKOVA 1960) KDS. 1968, cf. *Juglandaceae* — Plate III, 1—3; *Subtriporopollenites* fsp., cf. *Juglandaceae, Carya* — Plata II, 28—30), further on the *Boehlensipollis* fsp. (Plate III, 28—30), the *Gallopollis minimus* GRUAS—CAVAGNETTO 1967 subfsp. *concaviformis* GRUAS—CAVAGNETTO (Plate IV, 1—3), *Tricolporopollenites parmularius* (R. POT. 1934) W. KR. 1960 (Plate IV, 7—9), *Tetracolporopollenites halimbaense* KDS. 1961, *Sapotaceae* (Plate VI, 19—21 *Tetracolporopollenites ellipsus* KDS. 1965, *Sapotaceae* (Plate VI, 22—27), *Tetracolporopollenites ellipsus* KDS. 1965, *Sapotaceae* (Plate VI, 22—67), *Tetracolporopollenites hungaricus* KDS. 1965, *Sapotaceae* (Plate VI, 28—33).

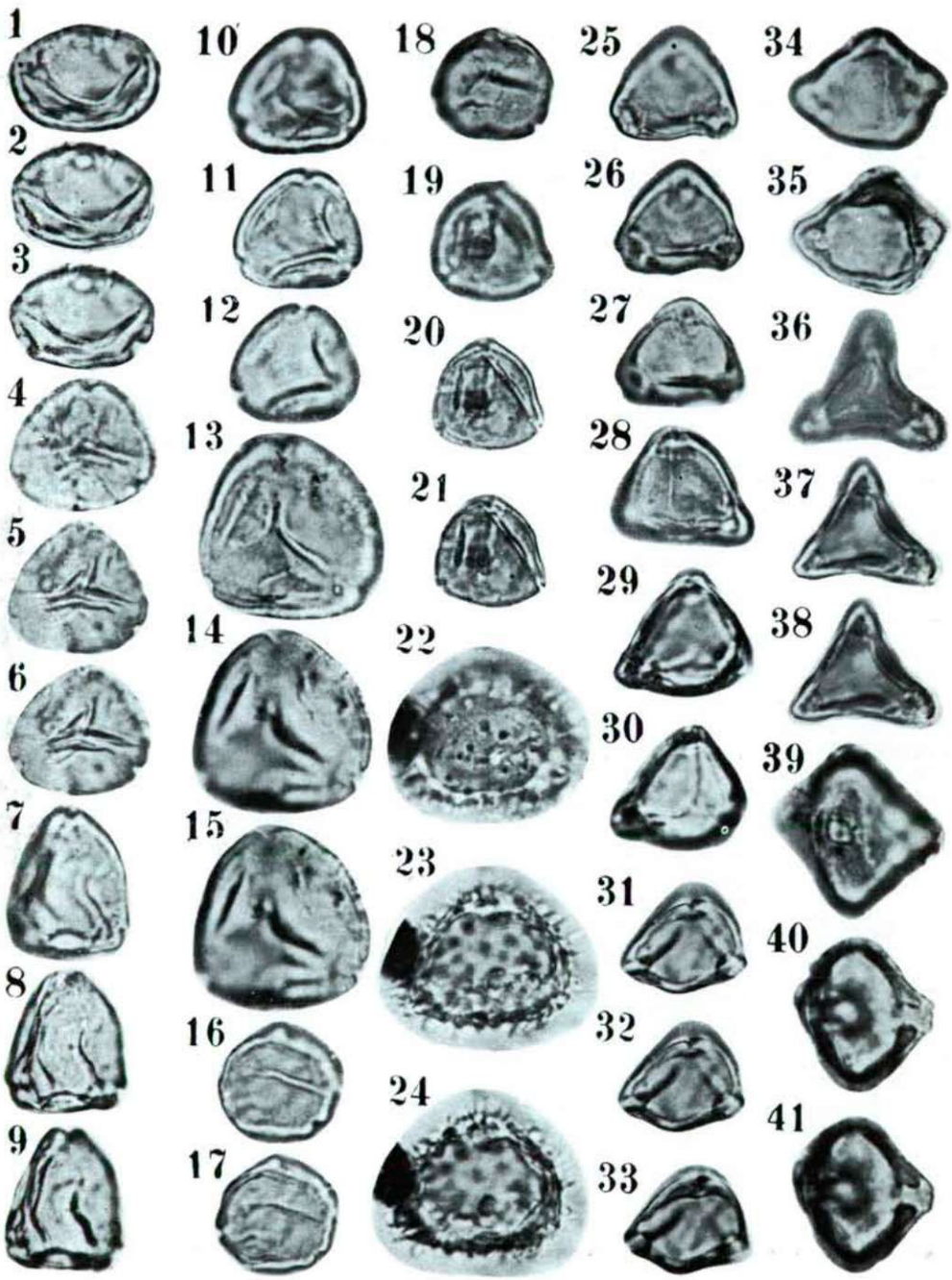
Types occurring first of all in palaeogene sediments are: *Plicatopollis* fsp.$_{1-4}$, *Juglandaceae* (Plate III, 4—15), *Compositoipollenites rhizophorus* (R. POT. 1934) R. POT. 1960 subfsp. *rhizophorus, Icacinaceae* (Plate III, 22—24), *Pentapollenites regulatius* W. KR. 1962 subfsp. *concavus* W. KR. 1962 (Plate III, 39—41, cf. 34—38), *Restioniidites hungaricus* (KEDVES 1965) ELSIK 1968, *Restionaceae* (Plate IV, 4—6).

Sporomorphous types occurring generally in Tertiary sediments are: *Polypodiaceoisporites* fsp., *Pteridaceae, Pteris* (Plate I, 1—3), *Sabalpollenites areolatus* (R. POT. 1934) R. POT. 1958, *Palmae* cf. *Trachycarpus* (Plate I, 7—9), *Sabalpollenites* fsp., *Palmae*, cf. *Sabal* (Plate I, 4—6), Cf. *Platycaryapollenites* fsp.$_{1-2}$, *Juglandaceae, Platycarya* (Plate III, 16—21), *Tricolporopollenites megaexactus* (R. POT. 1931) TH. & P:. 1953, *Cyrillaceae, Clethraceae* v. *Theaceae* (Plate IV, 10—12), *Tricolporopollenites cingulum* (R. POT. 1934) TH. & PF. 1953, subfsp. *oviformis* (R. POT. 1931a) TH. & PF. 1953, *Fagaceae, Castanea* v. *Castanopsis* (Plate IV, 13—15), *Tricolporopol-*

Plate III

1—3. —* *Subtriporopollenites facilis* (BOTCHARNIKOVA 1960) KDS. 1968, cf. *Juglandaceae;* prep. 0—33—40, 19,2/106,6.
4—6. — *Plicatopollis* fsp.$_1$, *Juglandaceae;* prep. 0—33—43, 4,4/116,9.
7—9. — *Plicatopollis* fsp.$_2$, *Juglandaceae;* prep. 0—33—39, 9,6/118,8.
10—12. — *Plicatopollis* fsp.$_3$, *Juglandaceae;* prep. 0—33—39, 5,6/111,2.
13—15. — *Plicatopollis* fsp.$_4$, *Juglandaceae;* prep. 0—33—16, 13,0/111,2.
16—18. —* *Platycaryapollenites* fsp.$_1$, *Juglandaceae, Platycarya;* prep. 0—33—42, 12,0/104,9.
19—21. —* *Platycaryapollenites* fsp.$_2$, *Juglandaceae, Platycarya,* prep. 0—33—38, 10,2/113,8.
22—24. — *Compositoipollenites rhizophorus* (R. POT. 1934) R. POT. 1960 subfsp. *rhizophorus ,Icacinaceae;* prep. 0—33—38, 18,2/109,7.
25—27. — *Incertae sedis, Dicotyledonopsida;* prep. 0—33—38, 18,1/109,7.
28—30. — *Boehlensipollis* fsp.; prep. 0—33—53, 8,9/118,2.
31—33. — *Incertae sedis, Dicotyledonopsida;* prep. 0—33—27, 20,9/106,0.
34—35. — *Pentapollenites* cf. *regulatius* W. KR. 1962 subfsp. *concavus* W. KR. 1962; prep. 0—33—1, 15,3/108,7.
36—38. — *Pentapollenites* cf. *regulatius* W. KR- 1962 subfsp. *concavus* W. KR. 1962; prep. 0—33—41, 7,8/107,7.
39—41. — *Pentapollenites regulatius* W. KR. 1962 subfsp. *concavus* W. KR. 1962, prep. 0—33—45, 21,4/113,1.

Plate III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lenites cingulum (R. POT. 1934) TH. & PF. 1953 subfsp. *pusillus* (R. POT. 1934) TH. & PF. 1953, *Fagaceae, Castanopsis* v. *Lithocarpus* (Plate IV, 19—21), *Tricolporopollenites cingulum* (R. POT. 1934) TH. & PF. 1953 subfsp. *fusus* (R. POT. 1931a) TH. & PF. 1953 (Plate IV, 22—24), *Tricolporopollenites krutzschi* (R. POT. 1931b) TH. & PF. 1953 subfsp. *analepticus* (R. POT. 1934) TH. & PF. 1953, *Nyssaceae* v. *Mastixiaceae* (Plate IV, 25—27), *Tricolporopollenites iliacus* (R. POT. 1931b) TH. & PF. 1953 f. *medius* PF. &TH. 1953, *Aquifoliaceae, Ilex* (Plate VI, 1—6), *Tricolporopollenites margaritatus* (R. POT. 1931a) TH. & PF. 1953 f. *medius* PF. & TH. 1953, *Aquifoliaceae, Ilex* (Plate VI, 7—9), *Tricolporopollenites margaritatus* (R. POT. 1931a) TH. & PF. 1953 f. *minor* PF. & TH. 1953, *Aquifoliaceae, Ilex* (Plate VI, 10—18).

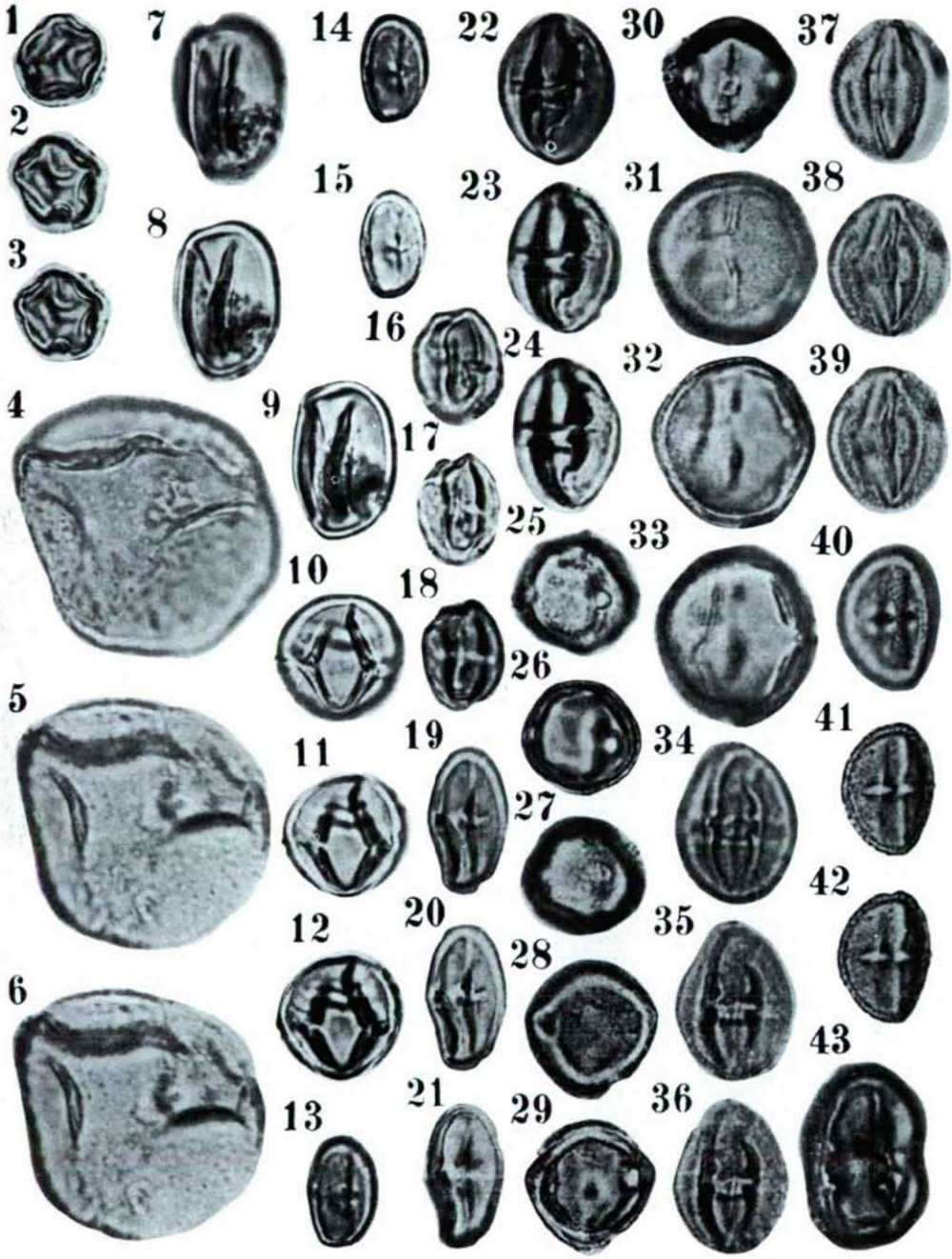
In view of their stratigraphic significance, there are unknown sporomorphae, for the time being: *Triporopollenites* fsp., cf. *Betulaceae* (Plate II, 14—16), *Incertae sedis, Dicotyledonopsida* (Plate III, 25—27, 31—33) *Tricolporopollenites* fsp.$_{1-11}$ (Plate IV, 16—18, 28—43, Plate V, 1—14), *Tricolporopollenites* cf. *striatoreticulatus* W. KR. 1962, *Simarubaceae, Picrasma* (Plate V, 15—17), *Tricolporopollenites aceroides* W. KR. 1961, *Rosaceae,* cf. *Pistacia* (Plate V, 18—20).

4. In connection with the plant ensemble reconstructed on the basis of the remains assemblage, we have agein to refer to the sediment investigated being of marine character, owing to the *Hystrichosphaeridae* remains mentioned above, and other ones, as well. Therefore, we can make an attempt at the littoral vegetation only largely. There are considerable the "ancient *Angiospermatophytae*" among that the genera of *Myricaceae* can occur, as well. In the greatest amount the pollen grains *Juglandaceae* occurred, the most important ones of them being the "caryoid" forms of ancient type; apart from them also the *Platycarya* and other forms that are unknown concerning their nearer botanical connections are frequent. Further on, the amount of *Fagaceae (Castanea, Castanopsis, Lithocarpus) Aquifoliaceae (Ilex)* and *Sapotaceae* remains are noteworthy. The occurrence of *Palmae* (cf. *Sabal,* cf. *Trachycarpus*), cf. *Betulaceae, Icacinaceae, Cyrillaceae, Clethraceae* v. *Theaceae,*

Plate IV

1—3. — *Gallopollis minimus* GRUAS-CAVAGNETTO 1967 subfsp. *concaviformis* GRUAS-CAVAGNETTO 1967; prep. 0—33—39, 4,8/103,7.
4—6. — *Restioniidites hungaricus* (KEDVES 1965) ELSIK 1968, *Restionaceae;* prep. 0—33—43, 13,4/115,0.
7—9. — *Tricolporopollenites parmularius* (R. POT. 1934) W. KR. 1960; prep. 0—33—38, 8,4/108,6.
10—12. — *Tricolporopollenites megaexactus* (R. POT. 1931) TH. et PF. 1953, *Cyrillaceae, Clethraceae* v. *Theaceae;* prep. 0—33—40, 19,6/106,8.
13—15. — *Tricolporopollenites cingulum* (R. POT. 1934) TH. et PF. 1953 subfsp. *oviformis* (R. POT-1931a) TH. et PF. 1953, *Fagaceae, Castanea* v. *Castanopsis;* prep. 0—33—38, 5,8/113,6.
16—18. — *Tricolporopollenites* fsp. , cf. *Sapindaceae, Eurycorymbus;* prep. 0—33—39, 7,3/103,8.
19—21. — *Tricolporopollenites cingulum* (R. POT. 1934) TH. et PF. 1953 subfsp. *pusillus* (R. POT. 1934) TH. et PF. 1953, *Fagaceae, Castanopsis* v. *Lithocarpus;* prep. 0—33—42, 11,0/104,1.
22—24. — *Tricolporopollenites cingulum* (R. POT. 1934) TH. et PF. 1953 subfsp. *fusus* (R. POT. 1931a) TH. et PF. 1953, *Fagaceae;* prep. 0—33—41, 20,5/116,6.
25—27. — *Tricolporopollenites krutzschi* (R. POT. 1931b) TH. et PF. 1953 subfsp. *analepticus* (R. POT. 1934) TH. et PF. 1953, *Nyssaceae v. Mactixiaceae;* prep. —033—39, 21,3/117,7.
28—30. — *Tricolporopollenites* fsp.$_2$; prep. 0—33—18, 17'8/107,0.
31—33. — *Tricolporopollenites* fsp.$_3$; prep. 0—33—42, 7,7/120,4.
34—36. — *Tricolporopollenites* fsp.$_4$; prep. 0—33—41, 7,1/113,5.
37—39. — *Tricolporopollenites* fsp.$_5$; prep. 0—33—42, 20,8/117,6.
40—42. — *Tricolporopollenites* fsp.$_6$; prep. 0—33—22, 10,5/103,1.
43. — *Tricolporopollenites* fsp.$_7$; prep. 0—33—40, 5,5/113,4.

Plate IV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Nyssaceae v. *Mastixiaceae*, *Simarubaceae (Picrasma)*, *Rosaceae* (cf. *Pistacia)*, *Sapindaceae (Eurycorymbus)* is minimal.

The mentioned plants of *Angiosperms* are of ligneous stem and first of all staeminated by wind. Those of soft stems are referred to partly by the unique *Pteridaceae* type resp. a tropical sort of grass: *Restionaceae* pollen.

Discussion of results

1. The general composition of the spore-pollen assemblage is referring to the lower Tertiary period. The geological age of the sediment investigated on the basis of the *Normapolles* stemma being rich in genera, of the great number of the "ancient caryoid" pollen grains, of the palaeogene types, *Gallopollis minimus concaviformis* described from the Sparnacian sub-stage, *Tricolporopollenites parmularius*, *Sapotaceae* found in our material, and as well those enumerated in the other previous places, was described as lower Eocene. Compared with the pollenstratigraphic tables made so far concerning Europe, the Cuisian sub-stage in the low level of the most probable nearer period, but the upper part of the Sparnacian sub-stage isn't excluded, either. Against the latter possibility speaks the occurrence of *Boehlensipollis* fgen. that was, so far, found in younger palaeogene layers. Thus our results concerning the geologic age are essentially identical with SCHAUB's conception (1960).

2. Our data are referring to that the types of the spore-pollen assemblage which are important from the point of view of geological period, can be identified with the forms recognized from other territories of Europe, first of all from the classic sediments of the Paris basin.

3. Owing to the maritime character of the sediments and their being relatively rich in sporomorphs, further investigations are needed for a more perfect knowledge of the vegetation.

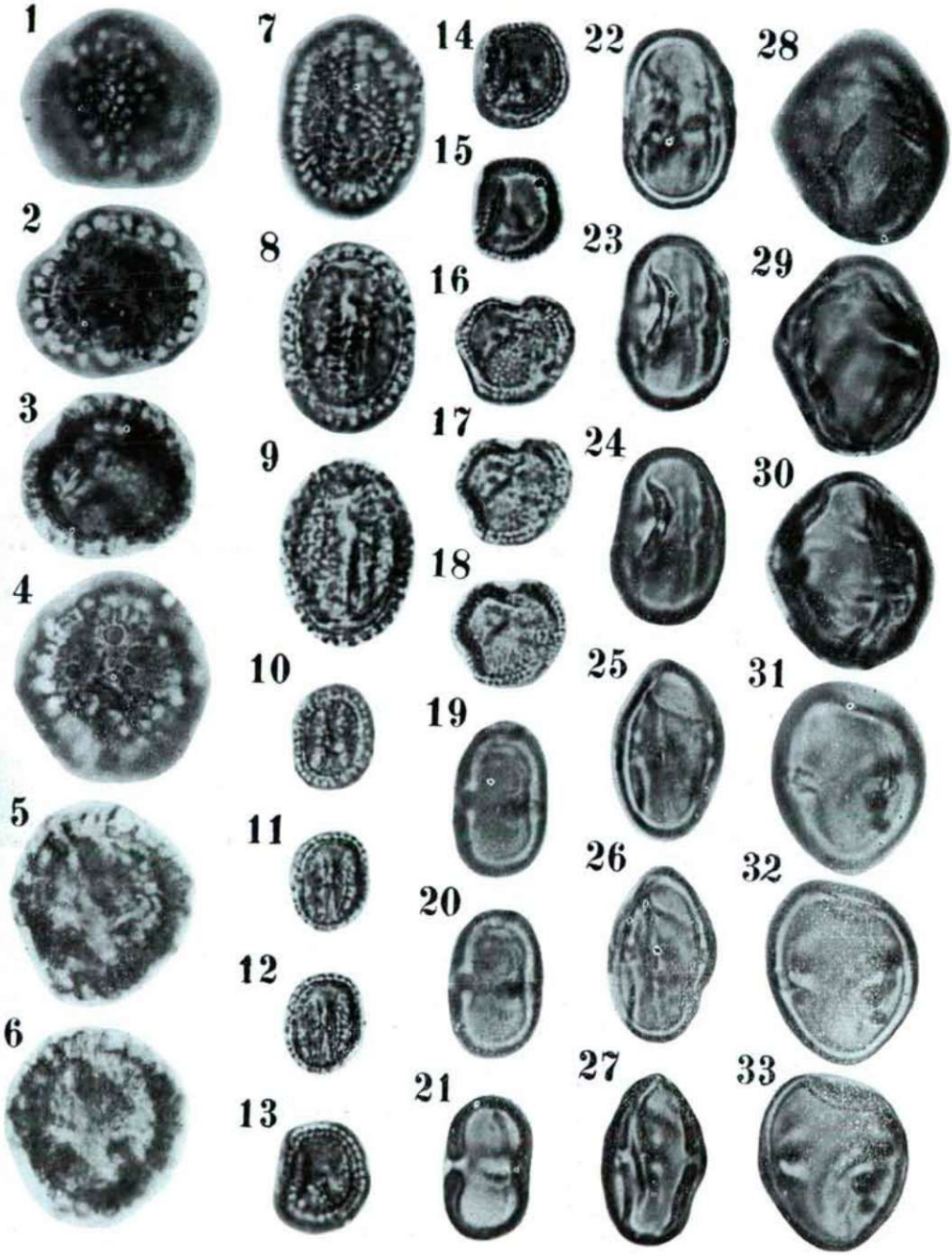
Summary

1. The examinated marl layers of Mte. Bolca, are extremely rich in *Hystrichosphaeridae* remains; on the other hand, they are relatively poor in sporomorphs. The remainder ensemble demonstrated is first of all denoting the lower level of the

Plate V

1—3. — *Tricolporopollenites iliacus* (R. POT. 1931b) TH. et PF. 1953 f. medius PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep, 0—33—36, 5,6/114,4.
4—6. — *Tricolporopollenites iliacus* (R. POT. 1931b) TH. et PF. 1953 f. *medius* PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep. 0—33—44, 22,0/115,9.
7—9. — *Tricolporopollenites margaritatus* (R. POT. 1931) TH. et PF. 1953 f. *medius* PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep. 0—33—40, 6,4/102,1.
10—12. — *Tricolporopollenites margaritatus* (R. POT. 1931a) TH. et PF. 1953 f. *minor* PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep. 0—33—38, 7,9/111,8.
13—15. — *Tricolporopollenites margaritatus* (R. PTO. 1931a) TH. et PF. 1953 f. *minor* PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep. 0—33—41, 18,9/115,0.
16—18. — *Tricolporopollenites margaritatus* (R. POT. 1931a) TH. et PF. 1953 f. *minor* PF. et TH. 1953, *Aquifoliaceae, Ilex;* prep. 0—33—39, 7,6/114,5.
19—21. — *Tetracolporopollenites halimbaense* KDS. 1961, *Sapotaceae;* prep. 0—33—41, 7,1/103,9.
22—24. — *Tetracolporopollenites ellipsus* KDS. 1965, *Sapotaceae;* prep. 0—33—39, 10,3/106,2.
25—27. — *Tetracolporopollenites ellipsus* KDS. 1965, *Sapotaceae;* prep. 0—33—38, 15,5/108,1.
28—30. — *Tetracolporopollenites hungaricus* KDS. 1965, *Sapotaceae;* prep. 0—33—38, 21,6/112,9
31—33. — *Tetracolporopollenites hungaricus* KDS. 1965, *Sapotaceae;* prep. 0—33—42, 18,5/111,9.

Plate V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Cuisian sub-stage in view of the geological age of the sediment but the upper level of the Sparnacian sub-stage is possible, as well.

2. On the basis of our results, the Mediterranean region and the sporomorphae assemblages in Central and Western Europe don't differ from each other in their essential types and can be compared well from the point of view of stratigraphy.

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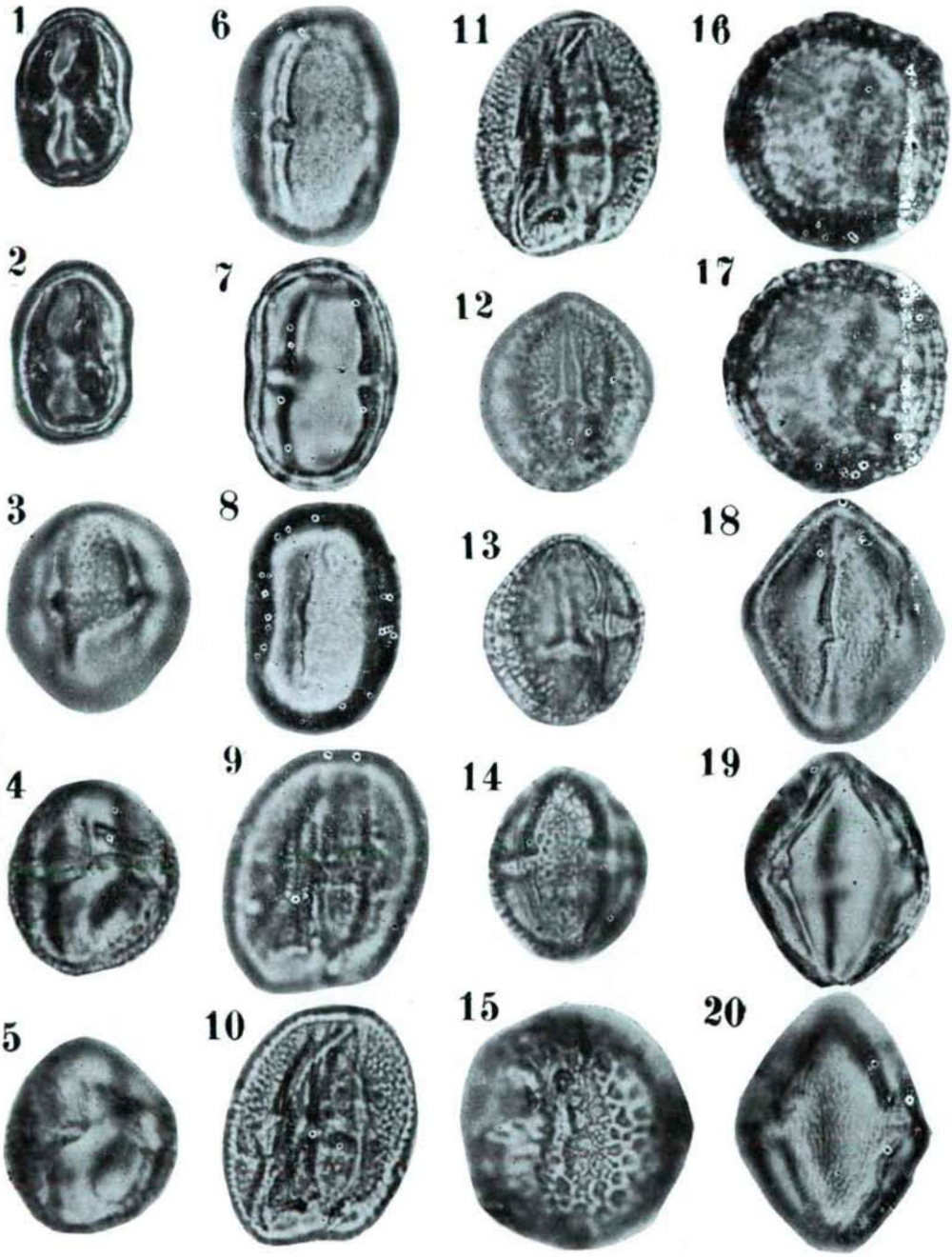
Plate VI

1—2. — *Tricolporopollenites* fsp.$_{.7}$; prep. 0—33—40, 5,5/113,4.
3—5. — *Tricolporopollenites* fsp.$_{.8}$; prep. 0—33—24, 6,0/118,4.
6—8. — *Tricolporopollenites* fsp.$_{.9}$; prep. 0—33—17, 11,6/111,2.
9—11. — *Tricolporopollenites* fsp.$_{.10}$; prep. 0—33—45, 19,8/105,1.
12—14. — *Tricolporopollenites* fsp.$_{.11}$; prep. 0—33—42, 22,6/110,1.
15—17. — *Tricolporopollenites* cf. *striatoreticulatus* W. KR. 1962, *Simarubaceae, Picrasma;* prep. 0—33—21, 21,2/108,4.
18—20. — *Tricolporopollenites aceroides* W. KR. 1961, *Rosaceae*, cf. *Pistacia;* prep. 0—33—30, 15,9/116,0.

Plate VI



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Acta Biologica Szeged 16 (1—2), pp. 69—79 (1970)

SPOREN-, POLLEN- UND MOORTYPEN AUS DEM MIOZÄNEN BRAUNKOHLENGEBIET VON NÓGRÁD II

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(Eingegangen am 28 November 1968)

In dem ersten Teil dieser Arbeit wurden die Sporen- und Pollentypen mitgeteilt, die im Braunkohlengebiet von Nógrád vorgekommen sind. In diesem zweiten Teil werden die kohlenbildenen Moortypen und die palynologisch angenommene Ausbildung der Nógráder Braunkohlenflöze besprochen.

Die helvetischen Moortypen des Kohlenbeckens in Nógrád

Der Gedanke, dass die Sporenspektren der Braunkohlenproben nach Moortypen und Moorzonen gewertet werden sollen, ist in die Palynologie in den 1950-er Jahren übergangen. Hauptsächlich THOMSON (1951, 1952, 1953, 1955, 1956) hat auf diesem Gebiet eine bahnbrechende Arbeit auf Grund der sporologischen Angaben der niederrheinischen Braunkohlen geleistet. In bezug aufs Paläogen hat PFLUG (1952) unsere Kenntnisse mit einigen neuen Erfolgen bereichert.

In Ungarn hat NAGY (1958, 1962b, 1965) verschiedene Pflanzengesellschaften, Vegetationszonen vom Pliozän am Mátrafuss und vom Neogen vom Mecsek-Gebirge auf palynologischem Grund demonstriert. Von der Helvetstufe der Katalingrube hat der VERFASSER (1960) mehrere Gesellschaften und ihre Sukzessionen aufgezählt. Und in Beziehung des Paläogens haben die Untersuchungen von KEDVES (1960, 1963) unsere auf die Kohlenfacies bezüglichen Kenntnisse erweitert.

Es ist vor den Palynologen bekannt, dass der Deckungsgrad verschiedener Schichten (Moos-, Kraut-, Strauch- und Baumschichten), die Filterwirkung der Pflanzendecke, die Verschiedenheit der Sporen-Pollenproduktion, der Sporen- und Pollentransport durch Wind und Wasser, die auch vom Klima abhängige Soziabilität der die Gesellschaft bildenden Arten, die Zeitdauer der Anhäufung des kohlenliefernden Pflanzenmaterials die wichtigsten Faktoren sind, die die Folgerungen über die Pflanzengesellschaften in der geologischen Vergangenheit auf palynologischem Grund unsicher machen. Wir sollen aber auch die momentan unsicheren Ergebnisse der Palynologie, der Paläozönologie festsetzen, denn die Palynologie liefert das reichste Beweismaterial zur Klärung der Entstehung der Kohlenflöze und zur Rechtfertigung des Moorzonensystems.

Die Rahmen der Zeitschrift gestatten uns nicht die quantitativen Angaben in eingehenden, sich bis zu den Sporen- und Pollentypen erstreckenden Diagrammen mitzuteilen. Statt dessen teilen wir Diagramme mit, die z. T. in ökologischen Gruppen zusammengezogen sind (Abbildung). Auf unseren Diagrammen sind links von der die Zahlen der Proben bezeichnenden Zifferkolonne die Pollenprozente der für allochton gehaltenen Florabestandteile gegeben. Unter der Bezeichnung "*Abietaceae* etc." sind die prozentualen Werte der Pollenkörner von Typen *Ginkgo, Pinus, Pseudotsuga* oder *Larix, Picea, Abies, Cedrus, Keteleeria,* ferner *Sciadopitys* und *Sequoia,* von denen die *Pinus*-Typen häufig, alle die anderen nur sporadisch sind.

Unter Bezeichnung "*Fagaceae* etc." werden *quercoide* Typen, *Castanea, Fagus, Carpinus, Ostrya, Corylus, Juglans, Pterocarya, Ulmus-Zelkova, Tilia* zusammengefasst; unter ihnen kann neben den quercoiden Typen auch *Ulmus-Zelkova* oft in grösserer Menge gefunden werden, alle die anderen sind sporadisch.

Rechts von der Zifferkolonne figurieren die quantitativen Angaben der Sporen und Pollenkörner der für hypautochton gehaltenen, also innerhalb des Moores gelebten Pflanzen. Unter dem Zeichen "*Sphagnum*" sind alle Angaben der Moos-, unter "*Pteridophyta*" diejenigen der Farnsporen gegeben worden. Unter den letzteren dominieren die *Osmunda-* und *Polypodiaceae*-Typen und hie und da kommen auch *Lygodiumsporen* in einer grösseren Menge vor.

Das Zeichen "*Taxodiaceae* etc." enthält neben den Typen von *Taxodium-Glytpostrobus* auch die nyssoiden Typen, die letzteren sind aber sporadisch.

Die Gruppe "*Myricaceae* etc." ist am wenigsten gegliedert, sie enthält die quantitativen Angaben der auf die Gattungen *Myrica, Engelhardtia, Carya, Cyrilla, Clethra, Ilex, Alnus, Betula* anweisenden Pollenformen.

Schliesslich mit dem Zeichen "*Sparganium* etc." gerieten die präsumierten Sumpfmonokotylen auf die Diagramme.

Moortypen des Flözes Margit III

Die Oberbank ist eine schon abgebaute Glanzkohle. Zur Untersuchung legen nur die Proben der Unterbank vor.

Probe 1: Süsswassermoorsee eventuell mit Inselchen, mit Auen von *Myrica, Salix,* cf. *Caprifoliaceae, Alnus* und *Taxodiaceae.*

Probe 2: *Myricaceae*-Buschmoor in der Krautschicht *Polypodiaceen* in grosser Deckung.

Probe 3: Gemischtes Busch—Waldmoor von *Myrica—Alnus—Betula.*

Proben 4—6: *Taxodiaceae*-Sumpfwald in der Krautschicht *Polypodiaceae* und *Osmunda.*

Probe 7: Pollenleere Glanzkohle.

Proben 8—9: Erlenmoor mit kleinerem Bestand von *Taxodiaceen, Myrica* und *Salix.*

Probe 10: *Taxodiaceae—Myricaceae*-Mischwald.

Probe 11: Myricaceae—Buschmoor mit *Salix-, Engelhardtia-, Taxodiaceae*-Auen.

Proben 12—17: *Taxodiaceae*-Sumpfwald mit *Myrica.*

Probe 18 (Liegendes): Baumarmes Moor mit Süsswasser.

MOORTYPEN DES FLÖZES POLYOS III

Probe 1 (Hangendes): Brackischer, salinarer See mit sekundärem Pollengehalt von *Taxodiaceen—Myricaceen.*

Proben 2—9: *Taxodiaceen—Myricaceen*-Mischwald in der Krautschicht mit einer grossen *Osmunda*-Deckung.

Proben 10—22: *Taxodiaceae*-Sumpfwald hie und da *Polypodiaceen*-Krautschicht in grosser Deckung.

Probe 23: Baumarme, offene Gesellschaft in der Krautschicht mit *Polypodiaceen,* in der Strauchschicht mit *Salix* und cf. *Caprifoliaceae,* in der Baumschicht mit *Taxodiaceae*-Auen.

Probe 24 (Liegendes): Pollenleerer, grauer Schwellton.

MOORTYPEN DES FLÖZES ÚJLAK III

Probe 1 (Hangendes): Brackischer, salinarer See mit sekundärem Pollengehalt; mit vielen *Osmunda.*

Proben 2—10: *Taxodiaceen—Myricaceen*-Mischwald in der Krautschicht mit vielen *Osmunda,* wenigeren *Polypodiaceen.*

Proben 11—13: *Taxodiaceae*-Sumpfwald in der Krautschicht mit dominierenden *Polypodiaceen,* wenigeren *Osmunda.*

Probe 14 (Liegendes): Baumarmes Moor mit Süsswassser, mit vielen *Monokotylen,* wenigen Sträuchern und Moorbäumen.

MOORTYPEN DES FLÖZES POLYOS II

Probe 1 (Hangendes): Offene Wasseroberfläche ohne Pflanzendecke, mit einem sekundären Sporen-Pollenhegalt, der aus einem nahen *Taxodiaceae—Myricaceae*-Mischwald gestammt hat.

Probe 2: Treibholz, geliefert durch Salzwasser.

Proben 3—8: *Taxodiaceen—Myricaceen*-Mischwald.

Probe 9: *Myricaceae*-Buschmoor.

Probe 10: *Myricaceae*-Gebüsch mit *Engelhardtia-, Betula-, Alnus-, Salix*-Auen und *Sphagnum*-Moosschicht.

Probe 11: *Taxodiaceae—Myricaceae*-Mischwald mit *Carya*-Auen.

Proben 12—13: *Ilex-, Myrica-* und *Salix*-Gebüsch, in der Krautschicht mit vielen *Osmunda.*

Probe 14 (Liegendes): Moorsee mit Sumpfmonocotylen.

MOORTYPEN DES FLÖZES GÁTI II

Probe 1 (Hangendes): Offener Moorsee mit einem sekundären Sporen-Pollengehalt und marinen *Hystrichosphaeridien.*

Proben 2—4: *Myricaceae-, Salix-, Taxodiaceae*-Mischwald.

Proben 5—8: *Myricaceae*-Buschmoor.

Proben 9—17: *Taxodiaceae—Myricaceae*-Mischwald.

Probe 18 (Liegendes): Moorsee mit vielen Sumpfmonocotylen, wenigen *Taxodiaceen* und mit *Salix-Cyrilla-Clethra*-Gebüschen.

MOORTYPEN DES FLÖZES KATALINBÁNYA II

Die Proben wurden nur nach Materialveränderungen gesammelt, die einzelnem Proben vertreten 3—60 cm dicke Kohlenschichten. Unter den Proben findet sich weder das Liegende, noch das Hangende.

Probe 1 (11 cm): *Myricaceae—Taxodiaceae*-Mischwald mit Dominanz des *Myricaceen*-Gebüsches.

Probe 2 (7 cm): Pollenleere Tuffeinlagerung.

Probe 3—4 (63 + 3 cm): *Taxodiaceae—Myricaceae*-Mischwald.

Probe 5 (7 cm): *Taxodiaceae*-Sumpfwald.

Proben 6—7 (59 + 25 cm): Pollenleere sandig-glimmerige Toneinlagerung.

Proben 8—11 (25 + 10 + 15 + 30 cm): *Myrica-, Cyrilla-, Salix—Ilex*-Buschmoor mit *Taxodiaceen*-Auen.

MOORTYPEN DES FLÖZES POLYOS I

Probe 1 (Hangendes): Offener Moorsee ohne selbständige Pflanzendecke.

Probe 2: *Myricaceae*-Buschmoor mit bedeutendem Bestand von *Taxodiaceen*.

Proben 3—6: *Myricaceae—Taxodiaceae*-Mischwald mit brackisch-marinen Algen.

Proben 7—10: *Myricaceae—Taxodiaceae*-Mischwald mit einer Krautschicht von *Polypodiaceen*.

Probe 11: *Myricaceae*-Buschmoor.

Probe 12 (Liegendes): Offener Moorsee mit sekundärem Pollenhegalt.

MOORTYPEN DES FLÖZES PÓCSHÁZA I

Probe 1 (Hangendes): Offene Wasserfläche mit sekundärem Pollengehalt und brackisch-marinen Kieselalgen.

Probe 2: Sporen-pollenleere kieselige Braunkohle.

Proben 3—16: *Myricaceae*-Buschmoor mit *Taxodiaceen*-Auen und mit einer Krautschicht von *Osmunda* und *Polypodiaceen*.

Probe 17: Offenerer Moorsee mit einem Pollenniederschlag von *Myricaceen*-Dominanz.

Probe 18 (Liegendes): Pollenleerer, glimmeriger Sand.

MOORTYPEN DES FLÖZES KATALINBÁNYA I

Die Probenahme geschah hier ebenso wie bei dem Flöz Katalinbánya II nach den Materialveränderungen. Von dem 2,4 m dicken Flöz standen nur 8 Proben zur Verfügung. Hangendprobe gibt es nicht.

Probe 1 (40 cm): Offener Moorsee mit nahem Bestand von *Taxodiaceen-Myricaceen*.

Proben 2—6 (6 + 50 + 4 + 70 + 50 cm): *Myricaceen*-Buschmoor mit *Taxodiaceen*-Auen.

Probe 7 (20 cm): Pollenarmer Ton mit Kohlenadern.

Probe 8 (Liegendes): Moorsee ohne selbständige Pflanzendecke, ev. mit Inseln, wo *Lygodium*, *Myricaceen*-Büsche und ein kleiner Bestand von *Taxodiaceen* vorgekommen sind.

MOORTYPEN DES FLÖZES MÉNKES I

Probe 1 (Hangendes): Süsswassermoorsee mit einem nahen *Myricaceen*-Buschmoor.

Probe 2: *Myricaceen*-Buschmoor.

Proben 3—7: Lockerer *Taxodiaceae*-Sumpfwald mit kleinerem Bestand von *Alnus* und *Betula*, in der Strauchschicht *Myricaceae, Cyrillaceae, Clethra* und *Ilex*, in der Krautschicht die *Osmunda*-Arten dominieren über den *Polypodiaceen*.

Probe 8: *Taxodiaceae—Myricaceae*-Mischwald.

Proben 9—15: *Myricaceen*-Buschmoor mit wenigem *Ilex*-Bestand und einigen Exemplaren von *Liquidambar*, mit *Taxodiaceen*-Auen. In der Krautschicht sind die *Polypodiaceen* mehr und mehr zurückgetreten.

Proben 16—20: Ausbildendes *Myricaceae*-Buschmoor mit bedeutenden Auen von *Salix* und *Taxodiaceen*, mit einer mehr und mehr ausgehednten *Polypodiaceen*-Krautschicht.

Probe 21 (Liegendes): Offener Moorsee, in der Nähe des Ufers mit *Salix*- und *Myricaceae*-Auen.

Die Ausbildung der Braunkohlenflöze in Nógrád

Die Probleme der Kohlenflözbildung sind hauptsächlich keine palynologischen Fragen, jedenfalls stützen sie sich auch auf paläobotanische Grundlagen und es bietet sich von selbst aus den Sporenspektren der Kohlenproben, aus den Pflanzengesellschaften und deren Sukzessionen, dass — die auf diesem Gebiet vorliegenden Möglichkeiten ausnützend — auch die flözgenetischen Folgerungen besprochen werden.

KRÄUSEL (1950) nimmt die Bildung der Kohlenlager von geringem Umfang durch Verladung mit Pflanzenmaterial an. Bei der Bildung grösserer Kohlenbecken mögen tektonische Bewegungen, Steigen und Senkungen des Grundwasserspiegels — JURASKY's (1936) Vorstellungen nach — eine Rolle gespielt haben.

Der VERFASSER (1960) hat, um JURASKY's Vorstellung zu demonstrieren, zwei Diagramme der Flözibldung verfertigt. Auf der 1. Abbildung der erwähnten Arbeit im Fall einer Flutung — wenn das Tempo der Bedeckung mit Wasser schneller war als die Bildung des Pflanzenmaterials — ist eine umgekehrte Sukzessionsreihe entstanden, d. h. auf der Base des Flözes haben sich der von TEICHMÜLLER (1958) übernommene *Sequoia*-Moorwald, dann das *Myricaceae*-Buschmoor, der *Taxodiaceae*-Sumpfwald, das Riedmoor und auf der oberen Partie des Flözes die Sedimente des Moorsees gezeigt.

Das Los der gegebenen Zonen ist von Abb. 2 der erwähnten Arbeit dargestellt, im Fall der Verladung des Beckens mit Pflanzenmaterial. Dann stimmt die Reihenfolge der Sedimentbildung von unter nach oben mit der Reihenfolge der Zonen von innen nach aussen gesehen, von dem Moorsee bis zum *Sequioawald*.

Flöze von grösserer Mächtigkeit konnten natürlich nur dann gebildet werden, wenn die Wasserbedeckung und die Bildung des Pflanzenmaterials miteinander Schritt gehalten haben.

Mit Rücksicht auf all dies und auf die im vorigen Abschnitt behandelten Pflanzengesellschaften, mag die Ausbildung der einzelnen Flöze in der folgenden Weise geschehen haben:

Flözbildung III begann mit einer Verladung des Süsswasserbeckens. Das Becken war im nördlichen (Salgótarjáner) Revier am tiefsten, wo in der untersuchten Stelle (Flöz Margit III) die Verladung mit dem Torf von einem *Taxodiaceen- (Taxodium-Glyptostrobus-)* Sumpfwald begann und mit einem *Myricaceen*-Buschmoortorf forgesetzt war. Die dann erfolgte Überschwemmung war für die Ausbildung eines gemischten Erlenmoores günstig, dann hat wiederholt ein Sumpfwaldtorf von *Taxodium—Glyptostrobus* abgelagert, gefolgt von einem *Myricaceae—Betula*-Mischwaldtorf und einem *Myricaceae*-Buschmoortorf und die Ausbildung der Unterbank des Flözes hörte schliesslich mit einer Süsswasserüberschwemmung auf. Die Vervollständigung der Sukzessionsreihe wurde also durch eine dazwischengekommene Überschwemmung gehindert und eine wiederholte Auffüllung wurde durch eine neuere Überschwemmung unterbrochen. — Die Umstände der Entstehung der Oberbank, — da sie schon früher abgebaut wurde, — sind unbekannt, aber es ist sehr wahrscheinlich, dass die Flözbildung dort einem weniger beweglichen, ruhigeren Prozess gemäss verlief.

In der Mittelzone des Kohlengebietes war das Flöz Polyos III in tieferliegender Teil des Beckens. In der Torfbildung des annehmlich Süsswasserbeckens konnte auch hier anfangs ein *Taxodium—Glyptostrobus*-Sumpfwald, den häufigen Überschwemmungen zufolge, ausgebildet werden, gefolgt später von einer überschwemmungsfreieren, trockneren Periode, was mit dem Zurückziehen des *Taxodium*-Sumpfwaldes und einem kleinerem Vorstoss des *Myricaceen*-Buschmoores zusammenhing. Die Flözbildung ist durch eine brackisch-marine Überschwemmung beendigt worden. Der trockenere *Sequoia*-wald, als Endzustand der Sukzessionsreihe, konnte sich auch hier nicht ausbilden.

Am westlichen Rand der Mittelzone, in dem Flöz Újlak III war das Becken von den untersuchten Stellen von Flöz III am flächsten. Die Flözbildung begann auch hier mit der Verladung eines Süsswassersees. Über dem Liegenden wurde der Torf von einem *Taxodium—Glyptostrobus*-Sumfpwald gebildet, dann ist der *Taxodium*-Sumpfwald in den Hintergrund gedrängt worden und ein Torf von einer mit *Myricaceen* und *Ilex* gemischten, trockeneren Gesellschaft bildete sich aus. Die Flözbildung wurde auch hier durch eine brackisch-marine Überschwemmung unterbrochen.

In der Ausbildung von Flöz III haben somit Süsswassermoorseen (eventuell auch Mündungs- und Flussedimente), *Taxodium—Glyptostrobus*-Sumpfwälder, *Myricaceae*-Buschmoore und Mischungen von denen teilgenommen, dann soll die Flözbildung durch eine Transgression beendet worden sein. Im Bereich von Flöz III hat sich kein *Sequoia*wald ausgebildet.

In der Ausbildung von Flöz II zeigt sich ein Unterschied zwischen dem südlichen Revier und der Mittelzone.

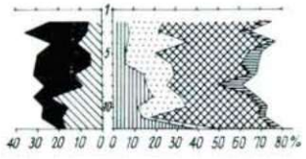
Das im südlichen Revier liegende Flöz Katalinbánya II lagerte sich auf ein pollenleeres Liegendes, beginnend mit einem Torf von einem *Myricaceae*-Buschmoor. Dieses Moor ist durch eine stufenweise Überschwemmung tiefer und tiefer geworden, bis ein offener See (Fluss oder Mündung) mit anorganischen Setimenten ausgestaltet wurde. Der Torf der Oberbank des Flözes ist durch eine regelmässige Verladung gebildet worden, beginnend mit einem *Taxodium---Glyptostrobus*-Sumpfwald ist er stufenweise in einen *Myricaceae*-Buschmoortorf übergegangen. Nachdem das Hangende keine Mikroreste enthält, ist es unbekannt, ob bie Flözbildung durch eine Überschwemmung von Salz- oder Süsswasser beendet wurde.

NORDBEREICH

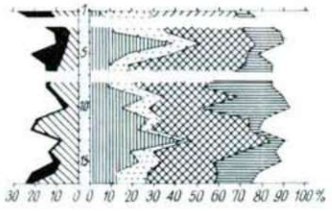
MITTELZONE

SÜDBEREICH

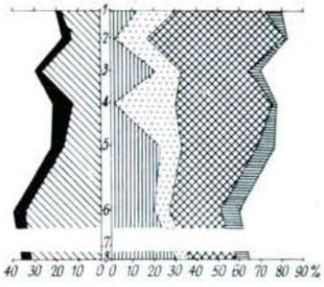
POLYOS I.



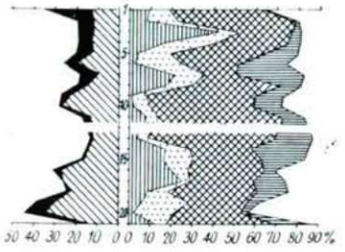
PÓCSHÁZA I.



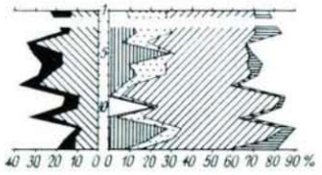
KATALINBÁNYA I.



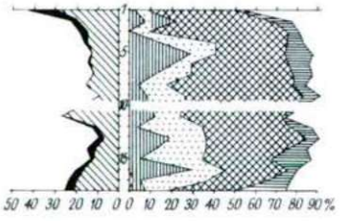
MÉNKES I.



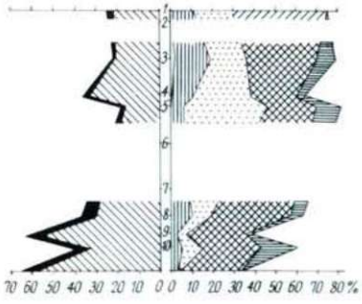
POLYOS II.



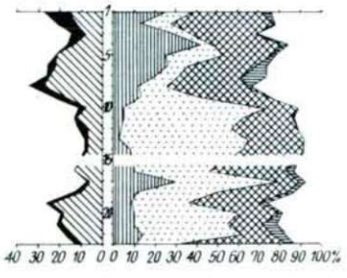
GÁTI II.



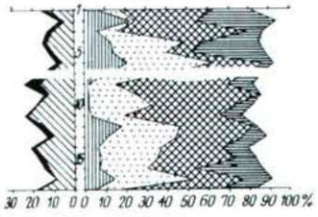
KATALINBÁNYA II.



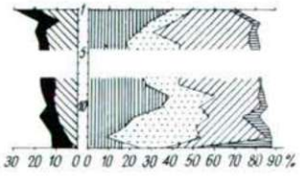
POLYOS III.



MARGIT III.



UJLAK III.



Abietaceae, etc.

Fagaceae, etc.

Sphagnum

Pteridophyta

Taxodiaceae, etc.

Myricaceae, etc.

Sparganium, etc.

In der Ausbildung der in der Mittelzone befindlichen Flöze (Polyos II und Gáti II) wicktelten sich im grossen und ganzen ähnliche Prozesse ab. Im Gebiet des Flözes Gáti II dauerte die Flözbildung eine längere Zeit als die in Polyos II. Die Verladung des anfänglichen Süsswasserbeckens begann mit dem Torf eines *Taxodiaceen-Myricaceen*-Moores, dann wurde sie auf einem Boden seichteren Wassers mit einem *Myricaceen*-Buschmoortort fortgesetzt. Nach der Auffüllung trat neuerlich eine Senkung ein, auf deren Boden sich ein Torf von einer gemischten *Myricaceen—Taxodium—Glyptostrobus—Salix*-Gesellschaft grösseren Wasseranspruches ausgebildet hat und die Flözbildung wurde schliesslich durch eine brakkisch-marine Überschwemmung beendet. Die Ausbildung des Flözes Polyos II brauchte eine kürzere Zeitdauer. Die Auffüllung des Süsswassersees (Mündugsgegend, Flusses) ist nach Ausbildung des Torfes von *Salix—Myrica—Ilex*-Auen in einen *Taxodium—Myricaceen*-Mischwaldtorf, später in einen *Myricaceen*-Buschmoortorf durch Verladung übergegangen, dann gestaltete sich mit dem Steigen des Grundwasserspiegels der Torf von einem gemischten *Taxodium—Gyptostrobus*- und *Myricaceae*-Moor grösseren Wasseranspruches und schliesslich wurde die weitere Ausbildung des Flözes durch eine brackisch-marine Überschwemmung unterbrochen.

In der Ausbildung von Flöz II hat also hie und da ausser dem Prozess der Verladung auch die eine umgekehrte Sukzession ergebende, langsame Überschwemmung eine Rolle gespielt. In der Mittelzone hat sicherlich die Transgression der See ein Ende bereitet, ebenso wie im Fall von Flöz III. In dem sütlichen Revier ist die Salzwasserfazies durch die bisherigen, palynologischen Untersuchungen nicht bestätigt worden.

Die Bildung von Flöz I im südlichen Revier dauerte eine längere Zeit als in der Mittelzone. Hier befinden sich die Flöze Ménkes I und Katalinbánya (Katalingrube) I. In Ménkes I waren mehrere Überschwemmungen von Süsswasser. Die Flözbildung begann mit den Sedimenten eines Moorsees, an den Ufern mit *Myricaceen-, Salix*-Auen. Später der Torf von einem gemischten *Taxodium—Glyptostrobus—Myricaceen*-Moor zeigt öftere Überschwemmungen. Dieser Torf ist mit der Torfbildung von einem *Myricaceen*-Moor fortgesetzt worden als Zeichen der Verladung des Beckenteils. Die danach erfolgten Überschwemmungen haben das Zurückdrängen des *Myricaceen*-Moores und den Vorstoss des *Taxodiaceen*-Moorwaldes mitgebracht, dann erfolgte neulich eine Auffüllung mit dem Torf von einem *Myricaceen*-Buschmoor. Auch das Hangende zeigt die Nähe eines *Myricaceen*-Moores. Die Flözbildung mag durch eine Überschwemmung unterbrochen worden sein, brackisch-marine Reste sind nicht gefunden worden.

Auch in der Ausbildung des Flözes Katalinbánya I, das dem Flöz Ménkes I sehr nahe liegt, kann die Bodenoszillation, die mit Pflanzengesellschaften bezeichnete Schwankung des Grundwasserspiegels, festgestellt werden. Die Probenahme war aber für den Zweck nicht geeignet, so kann die Entstehung des Flözes Katalinbánya I nur damit charakterisiert werden, dass es mit der Verladung eines Süsswasserbeckens begonnen hatte, ein *Myricaceen*-Buschmoor dominierte (hie und da mit *Taxodium—Glyptostrobus*-Auen) und die Flözbildung möglicherweise auch hier durch eine Überschwemmung von Süsswasser unterbrochen wurde.

In dem südlichen Teil der Mittelzone dauerte die Flözbildung mit wenigen Überschwemmungen nur eine kurze Zeit. Die Bildung des Flözes Pócsháza I begann mit der Verladung eines Moorsees, die Verhältnisse des Grundwassers waren für die Ausbildung eines *Myricaceen*-Moores, bzw. eines Torfes davon günstig. Die

ruhigeren, überschwemmungsfreien Bedingungen sind auch von den grossen Verbreitung der Farne bezeichnet. Die Flözbildung soll durch eine Meerestransgression beendet werden.

Die Ausbildung des in dem nördlichen Teil der Mittelzone befindlichen Flözes Polyos I dauerte eine noch kürzere Zeit. Die Sedimente des Liegenden zeigen Süsswasser. Darüber lagerte sich auf einem überschwemmungsfreien Boden ein Torf von einem *Myricaceen*-Buschmoor mit *Taxodium—Glyptostrobus*-Auen. Später waren die Überschwemmungen für die Anhäufung des Torfes von einem *Taxodium—Glyptostrobus*-Sumpfwald günstig. In der oberen Partie des Flözes mischte sich das süsse Grundwasser mit brackisch-marinem Wasser, so wurde die Weiterbildung des Flözes gewiss durch eine Transgression beendet.

Den obigen gemäss war die Ausbildung von Flöz I nicht einheitlich. Sie hat eine Identität nur in dem Sinne, dass auf den untersuchten Stellen im allgemeinen eine Verladung eines Süsswasserbeckens geschah und dass in dem südlichen Revier die Flözbildung durch Überschwemmung von Süsswasser, in der Mittelzone jedoch durch Meerestransgression beendet wurde. Im Gebiet bildete sich nirgends ein *Sequoia*wald aus. Die Unterschiede in den einzelnen Profilen lassen uns den Schluss ziehen, dass auch das paläogeographische Bild des Beckens von Flöz I sehr abwechslungsreich gewesen sein mag. Das Gebiet soll von Seen, Inseln gegliedert worden sein. Die Transgression richtete sich gewiss vom Norden nach Süden, eventuell hat sie das südliche Revier nicht einmal erreicht, sondern die Ausbildung von Flöz I wurde dort durch Überschwemmungen von Süsswasser unterborchen.

Zusammenfassung der I. und II. Teile

Es wurden von den kohlenproben des Braunkohlengebiets in Nógrád während einer qualitativpalynologischen Analyse 2 Sporentypen von *Bryophyten*, 41 von *Pteridophyten*, 18 Pollentypen von *Gymnospermen* und 115 von *Angiospermen* angeführt.

Wir waren bestrebt, auf grund der quantitativen Angaben des für hypautochton gehaltenen Sporen-Pollenmaterials die von den einzelnen Proben vertretenen Moortypen des Nógráder Helvets zu rekonstruieren. Wir machten den Versuch auf grund der die Braunkohle gebenden Moortypen (Moorsee, *Taxodium—Glyptostrobus*-Sumpfwald, *Myricaceae*-Buschmoor, Erlenmoor und Mischwälder von diesen) und deren Sukzessionen ein Bild über die Bildung der drei Kohlenflöze in Nógrád abzugeben.

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Acta Biologica Szeged 16 (1—2), pp. 81—83 (1970)

ON THE MECHANISM OF GIBBERELLIN - AUXIN INTERACTION V. EFFECT OF GIBBERELLIC ACID ON THE STABILITY OF RIBONUCLEIC ACID IN BEAN HYPOCOTYL TISSUES

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Introduction

As demonstrated in earlier works, the indoleacetic acid (IAA) contrcentation in bean hypocotyls can be considerably increased by treatment with gibberellic acid (GA). In the GA-treated hypocotyl tissues, parallel with the promotion of elongation, the level of free IAA and IAA-conjugates (VARGA and BITÓ, 1968; VARGA et al., 1968) as well as the quantity of IAA-macromolecule complexes, i. e. that of IAA bound to protein and RNA (VARGA, 1968; VARGA, KÖVES and SIROKMÁN, 1968) had considerably risen.

Later on we have carried out investigations about how the resistance of RNA against ribonuclease action is influenced by the increased IAA-RNA complex formation induced by GA. According to BENDANA and GALSTON (1965) when ^{14}C-IAA is fed to excised green pea-stem segments, growth is initiated, and there is a parallel progressive labelling of the RNA extracted by cold phenol. This fraction is more resistant to degradation by ribonuclease than a similar fraction obtained from tissues not treated with ^{14}C-IAA. On the basis of these data the question arises how the RNA fraction isolated from the GA-treated bean shoots behaves towards ribonuclease. With a logical deduction it might be expected that the GA-treatment, increasing the amount of IAA-RNA complexes, result in an increased resistance of RNA against enzymatic degradation.

Materials and Method

Young seedlings of *Phaseolus vulgaris* (var. *Golden Rain*) were raised in the way described earlier (VARGA and BITÓ, 1968). The intact shoots of six-day-old green seedlings were floated, under sterile circumstances, in a culture-medium containing 0, 5 and 50 ppm GA_3, in light (8000 lux), for 24 hours. After the incubation period, the quantitative extraction of the RNA fraction was carried out with the phenol-sodium dodecylsulfate method described by DINGMAN and SPORN (1962.)

Investigation of the resistance of the RNA fraction against ribonuclease action: an aliquot of RNA fractions was incubated in 0.1 M acetate buffer (pH 5.5) with crystalline pancreatic ribonuclease (10 μg/ml), for an hour, at 35 °C. The reaction was stopped with 0.5 ml of a mixture of uranyl acetate (0.75 percent) and perchloric acid (25 percent). The reaction mixture was then filtered through a 0.45 μ filter and the optical density of the filtrate was measured at 260 nm.

The ribonuclease used was a preparation of WORTHINGTON Biochem. Co.

Results and Discussion

Our hypothesis has been supported by the results of investigations: the RNA fraction isolated from shoots treated with 5 and 50 ppm GA was hydrolyzed more slowly by crystalline pancreatic ribonuclease than the corresponding fraction from untreated tissues (Fig. 1). Between the stabilizing effect of 5 and 50 ppm GA concentrations we have found no considerable difference; the resistance of the RNA fraction of the GA-treated and control tissues against ribonuclease differed, however, significantly. This increase of resistance — with regard to the results of BENDANA and GALSTON (1965) mentioned in the introduction — can be attributed to the fact that the RNA fraction isolated from GA-treated hypocotyl tissues is much richer in IAA-complexes than the RNA fraction of control tissues. According to our data, in the hypocotyls floated on GA-solution the amount of IAA bound to macromolecules is 4 to 6 times more than that found in the untreated hypocotyls (VARGA, 1968; VARGA, KÖVES and SIROKMÁN, 1968).

FLETCHER and OSBORNE (1966) suppose that the effect of GA comes into display partly by stabilizing the nucleic acids. The present experiments concerning the stability of RNA yielded some results reminding very much of this idea.

Summary

The RNA isolated from GA-treated bean hypocotyl tissues is more resistant to degradation by ribonuclease than the similar fraction obtained from untreated

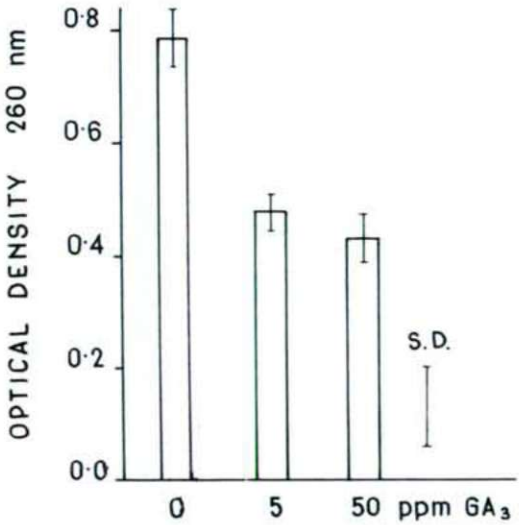

Fig. 1. Effect of GA on RNase resistance of the RNA fraction isolated from bean hypocotyls

control tissues. The increase of RNA-stability may be ascribed to the fact that in the GA-treated stem tissues the RNA fraction is much richer in IAA-complex than in the control.

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Acta Biologica Szeged 16 (1—2), pp. 85—93 (1970)

INVESTIGATION OF PHYSIOLOGICAL CHANGES IN ROOTS AND SHOOTS AS A RESULT OF A HERBICIDE TREATMENT I

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Introduction

The application of compounds of auxin effect as herbicides has been rendered possibly by the observation that the compounds, stimulating the growth in low concentration, are exerting a hindering effect if applied in a high concentration. This compound group includes, e. g., α-naphthyl acetic acid (NES), β-naphtoxy acetic acid; 4-chlorine-2-methyl-phenoxinacetic acid (McPAA) applied widely like a herbicide, at present too, 2,4-dichlorine-phenoxin-acetic acid (sodium salt, the Dikonirt), and 2,4,5-tri-chlorinephenoxin-acetic acid (2,4,5-T).

A decisive property of the phenoxin-acetic acid as a herbicide substance is its selective effect. Several monocotyledonous plants are essentially less sensitive to these compounds than the dicotyledonous ones generally, the cause of which may be looked for first of all, in the different metabolism of plants; anyway, the morphologic difference is also important, manifested in the different position or shape of leaves and in their hydrophilous or hydrophobic (wax layer) character, too. Apart from these, the form in which these compounds are applied, is also decisive in regard to selectivity because, as a result of their different polarity, they can penetrate into the plant tissues in different degrees.

Applying chemical herbicides systematically, we have to reckon with an accumulation of these in the soil that can have an influence also on the development of culture plants. We have adjusted our experiments on the basis of this reasoning, under conditioned circumstances, applying different concentrations of the sodium salt of 2,4-dichlorine-phenoxin-acetic acid (Dikonirt).

Material and Method

During our investigations we have treated the spring sort of barley MK 42, the yellow corn MV 530 of simple hybridization as monocotyledonous plants; the feeding peas IP and the striped sunflower from „Ireg" as dicotyledonous plants in an artificial plant experimental apparatus (HOR-

VÁTH—LASZTITY, 1965). sowing them into washed river sand and watering them with KNOPP's solution and Dikonirt solution of different concentrations, simultaneously with sowing (preemergent treatment).

Treatments:

Ist: untreated control
IInd: 0,125 g Dikonirt/growing vessel
IIIrd: 0,25 g Dikonirt/growing vessel
IVth: 0,5 g Dikonirt/growing vessel
Vth: 1,00 g Dikonirt/growing vessel
VIth: 2,00 g Dikonirt/growing vessel

The surface of one growing vessel is 0,12 sq. m.

The investigations were carried out in case of the monocotyledons after the first, resp. second leaves of the untreated plants had developed. In the artificial plant growing apparatus we used these dates were in case of barley the 7th and 14th days, of yellow corn the 11th and 17th days after sowing.

The growing vessels containing the grains of dicotyledons have been kept for 21 days in the artificial plant growing apparatus.

Measurings were performed for establishing the length of roots and shoots, resp. the number of roots and leaves; the fresh and dry weight of samples was determined as well as, after corroding with sulphuric acid, according to Nessler, the total nitrogen content and total phosphorus content of the leaves (FISKE—SUBAROW, 1925): finally, we established the change of plant respiration as a result of the treatment, with a manometric method.

Results

During our investigations, the pre-emergent Dikonirt-treatment had an intensive effect both on the monocotyledons and the dicotyledons. This effect has been manifested in a hundred percent inhibition of sprouting on both species of the dicotyledons investigated by us. The germination was thoroughly inhibited even by the treatment with a Dikonirt solution of low concentration applied in our experiments. On the

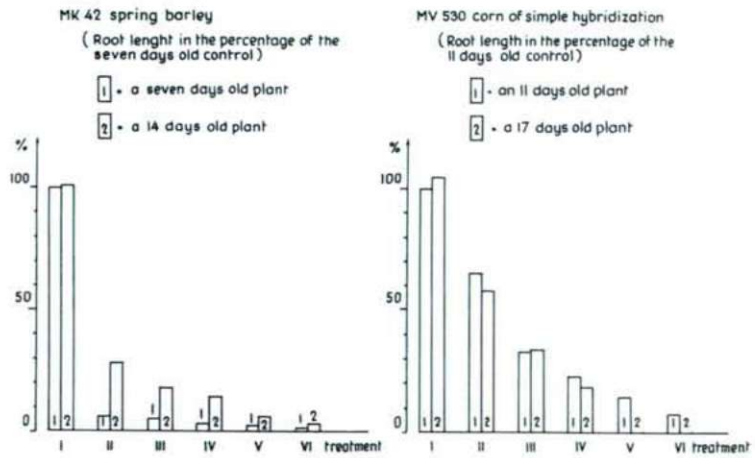

Fig. 1. Influence of pre-emergent Dikonirt treatment on the formation of root length of monocotyledonous culture plants.

21st day after sowing, opposite to the normally developed control, the germination still failed to start, resp. the seeds damped off.

An inhibition of germination of such a character and degree could not be demonstrated at either species of the two sorts of monocotyledons investigated by us, although a damaging effect could obviously be demonstrated in these plants, too. Increasing the Dikonirt concentration, the degree of the malformation of plants increased in parallel, as well. It could be well characterized with the results of phenologic measurements, the formation of the total phosphorus and nitrogen content, as well as with the intensity of breathing being increased.

As a result of the pre-emergent treatment, the increase in length both of yellow corn and of barley roots in inhibited, the degree of inhibition being a function of the Dikonirt concentration (Fig. 1). Anyhow, the two plants behave differently in course of time, as at the barley roots a definite increase in length could be demonstrated, as compared with the seven days old ones, in the 14th day of sprouting, while in case of the corn investigations, opposite to the control, we have found specimens with shorter roots at the second date than on the eleventh day of sowing.

In the formation of the number of roots there is similarly a difference between the Dikonirt-tolerance of barley and yellow corn (Fig. 2).

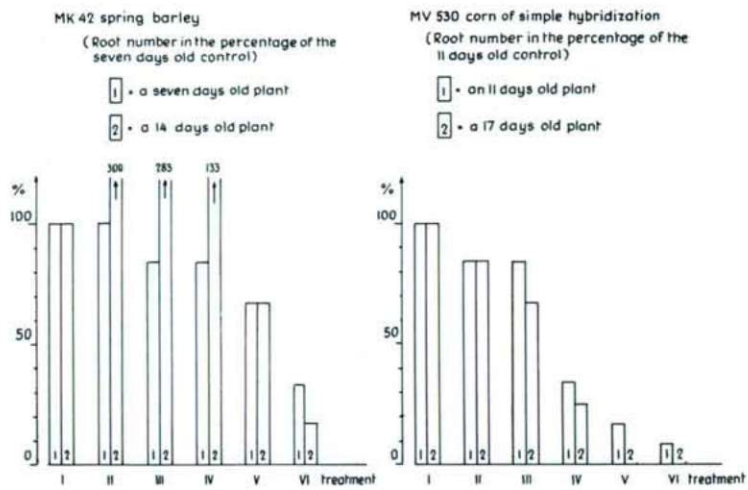

Fig. 2. Influence of pre-emergent Dikonirt treatment on the formation of the number of roots of monocotyledonous culture plants

0,125—0,5 g Dikonirt increased the number of barley roots on the 14th day after sowing, in a degree decreasing with raising concentration. The number of corn roots was always lower than that of untreated specimens although we can observe also here a high degree of cell proliferation and several shoot formations at samples treated with lower concentration.

In the longitudinal growth of barley shoots similar to the root increase, a significant increase can be demonstrated in every case, at the second date of investigation, while in case of corn this is caused only by the two solutions of thinnest concentration. As a result of concentrated solutions, we found smaller plants on the 17th day of sowing than on the 11th day (Fig. 3).

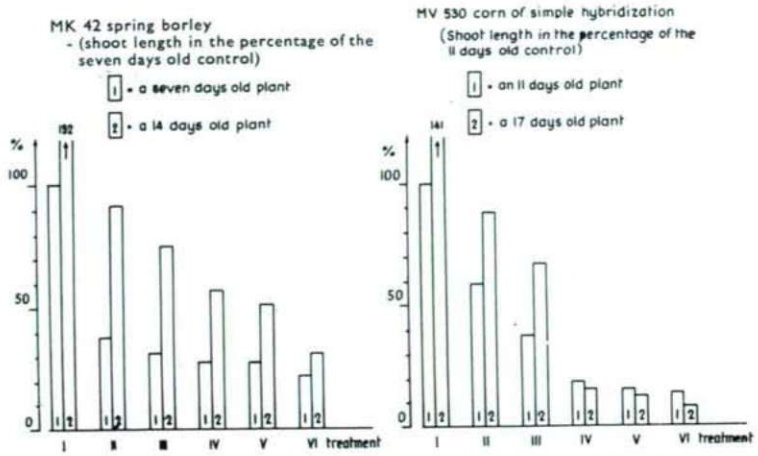

Fig. 3. Influence of pre-emergent Dikonirt treatment on the formation of the shoot length of monocotyledonous culture plants

It is shown also by the formation of the number of leaves (Fig. 4) that the development of both barley and yellow corn is inhibited by Dikonirt, at a low concentration, however, this influence can by mastered by the plant in some degree. As a result of 0,5—2 g Dikonirt, the number of the leaves of barley does not increase; owing to the inhibited development, a leaf is possibly formed from the epicotyle; at the corn, however, there cannot be found the leaves stage on the 17th day after sowing, only on the 11th day.

The Dikonirt treatment has an influence also on the development of fresh weight of the plants investigated, since as a result of treatment the fresh weight

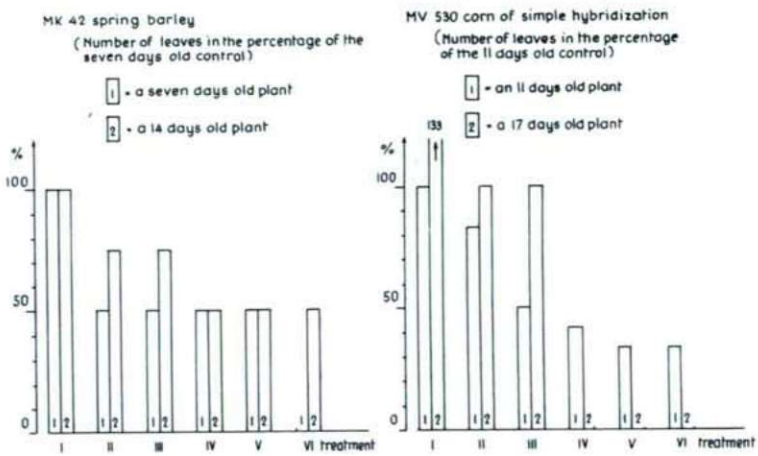

Fig. 4. Influence of pre-emergent Dikonirt treatment on the formation of the number of leaves of monocotyledonous culture plants

of barley is, always essentially lower than that of control. The same can be observed at the corn, as well. The difference between the Dikonirt tolerance of both plants is shown by the fresh weight of barley which increases in every case depending on time, while that of corn is decreasing (Fig. 5).

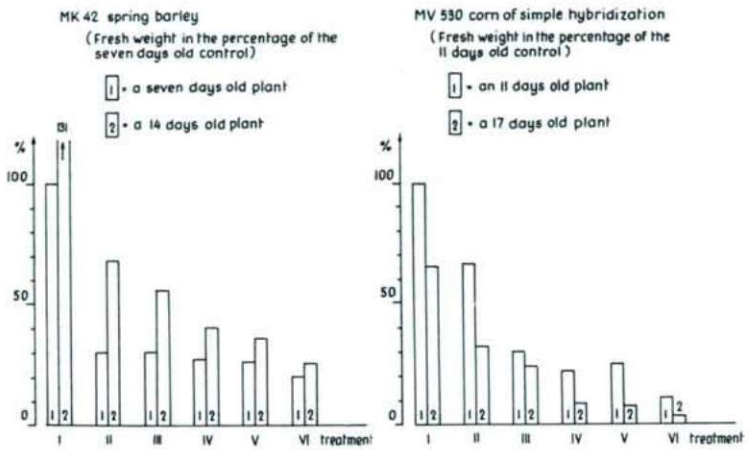

Fig. 5. Influence of the pre-emergent Dikonirt treatment on the formation of the fresh weight of monocotyledonous culture plants

As a result of treatment the dry weight of barley, is higher in every case than that of control, and at the second date of investigation it is higher than at the first one. The latter phenomenon can be observed also in case of corn; in this case, however at the first date of investigation, the dry weight content is nearly the same as, or lower than, that of control; and at the second date, it is nearly identical or higher, (Fig. 6).

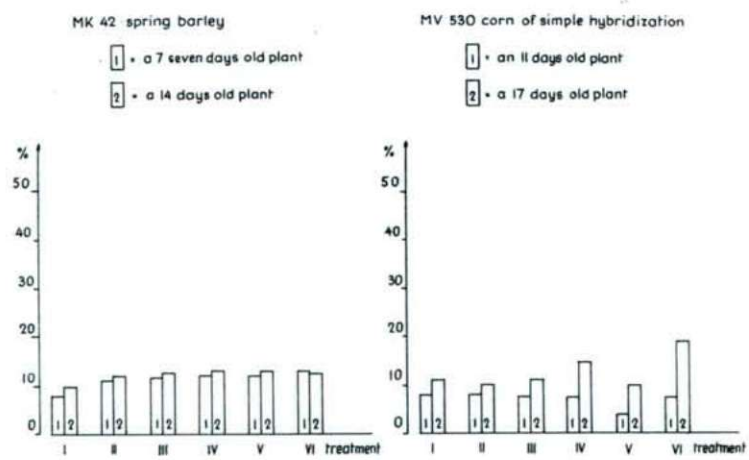

Fig. 6. Influence of the pre-emergent Dikonirt treatment on the formation of the dry weight o monocotyledonous culture plants
(Dry weight content in the percentage of the fresh weight)

The total nitrogen content referred to one plant increases in barley, except the VIth treatment, depending upon time, without reaching in any case the value of the corresponding control; in yellow corn we measured on the 17th day after sowing a total nitrogen content higher than on the 11 th day, as a result of treatment III and IV, in other cases we have noticed a decrease.

Taking into consideration the formation of percentages, it is obvious how very low the level of the total nitrogen content of the yellow corn is as compared with that of barley (Fig. 7).

The total phosphorus content in barley increases in every case till the 14th day after sowing, while in the corn it decreases (Fig. 8).

As a result of treatment the intensity of respiration increases in both plants. The oxygen uptake of barley leaves increases with age, while that of corn shows a changing tendency (Fig. 9).

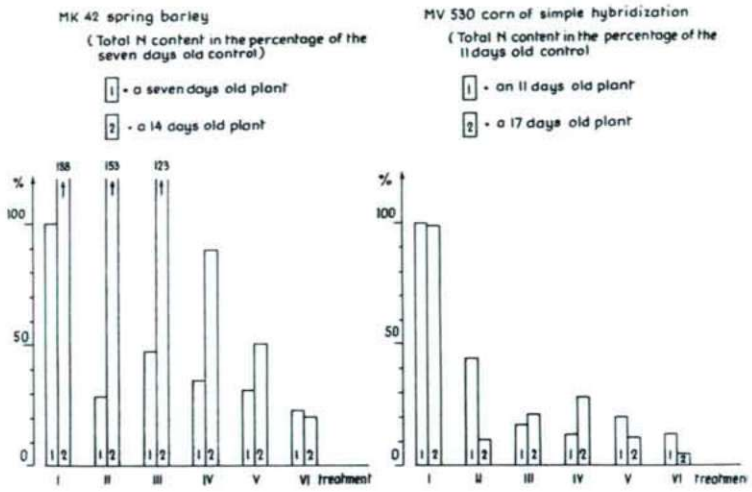

Fig. 7. Influence of the pre-emergent Dikonirt treatment on the total nitrogen content of monocotyledonous culture plants
MK 42 spring barley

Discussion

It may be established, therefore, on the basis of the results recited that Dikonirt, even in a quantity of 0,125 g/growing vessel, has an influence, with a pre-emergent treatment, on the development of both the monocotyledonous and the dicotyledonous plants. This effect causes, in case of the dicotyledons, the loss of grain vitality, thus bringing about the full inhibition of sprouting.

This cannot be observed on monocotyledonous plants, although during our investigations a characteristic damage could be demonstrated as a result of any treatment.

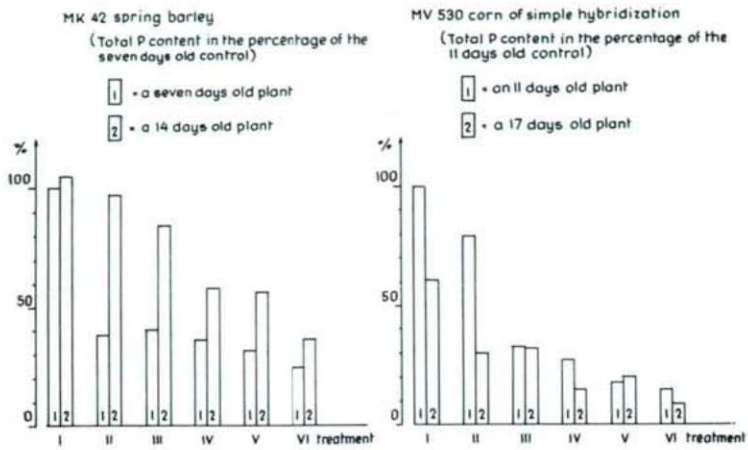

Fig. 8. Influence of the pre-emergent Dikonirt treatment on the total phosphorus content of monocotyledonous culture plants

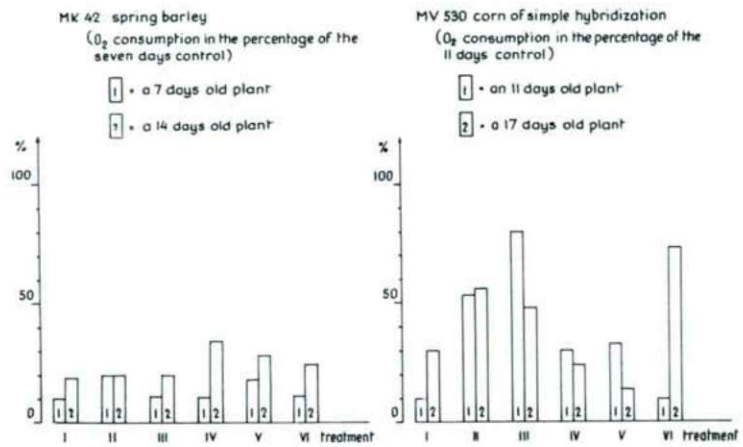

Fig. 9. Influence of the pre-emergent Dikonirt treatment on the respiration of monocotyledonous culture plants

Both monocotyledons showed characteristic differences concerning Dikonirt tolerance, and an increase of damage as a result of a raised concentration can be demonstrated, similarly to the results of the investigations of LIDER et al. (1966) carried out with simazine and diuron.

The rooting-inhibitory influence of the triazine derivatives is discussed by LEONARD et al. (1964) and BINGHAM (1967). It is emphasized by IVENS (1964) in connection with applying these derivatives, that this effect influences much less a further development of plants with already fully developed roots.

The present work has demonstrated an effect of this character of Dikonirt. In this way, Dikonirt with a growing concentration inhibits the formation of roots resp. the longitudinal growth more and more. Simultaneously it can be observed that, as a result of a treatment of low concentration, an intensive tissue proliferation is starting under the influence of auxin.

The total phosphorus and nitrogen contents of the samples decreases considerably owing to the treatments, similarly to the observations of EASTIN and DAVIS (1967) on different species treated with triazine derivatives. Simultaneously we can notice the decrease of fresh weight, together with the relatively increasing value of dry weight. On the basis of results the water circulation, i. e., water content of plants seems to decrease, owing first of all to the decreased root function. It is remarkable that, compared on a percentage basis, in corn both the nitrogen and the phosphorus contents were lower than is barley.

According to literary data, the herbicides inhibit the synthesis of chlorophyl (HERRETT—BERTHOLD, 1965), resp. the oxygen production of the isolated chloroplasts (HURTER et al., 1968). These results are not contradicted by our observation according to which the oxygen uptake is increased by Dikonirt treatment.

The conclusion can be drawn from our results that the pre-emergent Dikonirt treatment has a damaging influence, in this way, not only on the two investigated dicotyledonous species but also on the monocotyledons, by inhibiting the development of roots and disturbing the balance of metabolism; this effect can be demonstrated by the increase of respiration and the different fertilizer supply, as well. Also the yellow corn and barley behave in a different way if treated with Dikonirt, as barley — even if in a low degree — develops in the course of time, while corn perishes in case of a high concentration. Thus we could find at the second date of investigation specimens of smaller size and without leaves that developed, owing to the antigerminative effect of Dikonirt, while the plants that had developed earlier perished.

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Acta Biologica Szeged 16 (1—2), pp. 95—98 (1970)

INVESTIGATION OF PHYSIOLOGICAL CHANGES IN ROOTS AND SHOOTS AS A RESULT OF A HERBICIDE TREATMENT (II) DEVELOPMENT OF THE PIGMENT CONTENT OF SHOOTS

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(Received July 21, 1969)

Introduction

It is demonstrated both by our experiments so far and the literary data that, after the roots are removed, a considerable change in the pigment content takes place in the isolated leaves, parallel with the starting protein hydrolysis (CHIBNALL—WILTSHIRE, 1954; UDVARDY—HORVÁTH; HORVÁTH—LASZTITY, 1967). In our experiments for studying the physiological role of roots we have investigated the effect of 2,4-dichlorine-phenoxin-acetic acidits sodium salt being the Dikonirt. We have obtained the result that the Dikonirt treatment has a damaging effect not only on the two species of dicotyledons investigated by us but on the monocotyledons, as well. A common effect can be noticed on the inhibition of root development and on the perturbation of the balance of metabolism (LONTAI—HORVÁTH, 1969). At present we are investigating the change in pigment content as a physiological index reacting sensitively to the absence of roots, resp. to the damage of root function.

Material an Method

Our experimental plant was the MFB barley species, grown in an artificial plant growing apparatus (LASZTITY—HORVÁTH, 1965). The Dikonirt treatment was applied at the leaves of the seven days old plants (Postemergent treatment).

The following variations were investigated:

(1) untreated control,
(2) 0,125 g Dikonirt/0,12 sq. m,
(3) 2,000 g Dikonirt/0,12 sq. m.

The Dikonirt was sprayed to the plants after being dissolved in tap-water. The experiment was carried out in five repetitions. The change of the pigment content was noticed according to the method described by HORVÁTH—LASZTITY (1965), LASZTITY—HORVÁTH (1965), on the first and fourth days.

Discussion

Fig. 1 shows the development of the total pigment content on the first and fourth days after spraying.

In the total pigment content in the leaves of control plants we can observe the continuous increase untill the plants get 11 days old, while in the leaves sprayed, on the day after the treatment, a considerable decrease is caused by a higher Dikonirt concentration and a milder one in case of a lower concentration. The decrease in pigment content caused by the spraying is obvious four days after the treatment as compared with the control. At the control, the increase of the total pigment

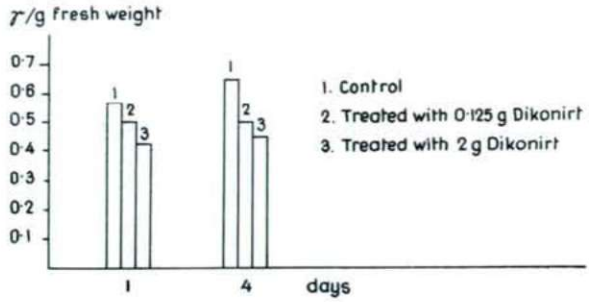

Fig. 1. Development of the total pigment content after spraying

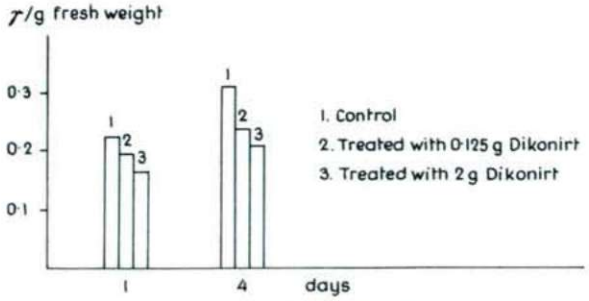

Fig. 2. Change of the quantity of chlorophyl-*a* and *b* after spraing

content is in a linear relation to the increase by division of the barley leaf that lasts till the 12th day. An increase of negligible value can be noticed also at the plants treated but, depending on the concentration, a destruction is caused in the quantity of pigments by Dikonirt.

In Fig. 2, the development of chlorophyl-*a* and *b* is demonstrated as a result of Dikonirt spraying, and in Fig. 3, the quantitative change of carotene.

In Fig. 2 we can observe that the amount of chlorophyl-*a* and *b* in the control plant is growing till the 11th day.

The quantity of green components has decreased as depending on the concentration of Dikonirt spray, both on the first and fourth days after spraying. Only the quantitative increase connected with the plant growth can be seen at the 11 days

old plants. The destructive effect of Dikonirt spray (post-emergent treatment) is of equal degree both on the first and fourth days after spraying.

In the carotene content of control plants, we couldn't observe any change at 8 and 11 days old plants, as shown by Fig. 3. The quantity of carotene has considerably decreased after being sprayed with Dikonirt of high concentration, but in case of a lower concentration it has decreased in a lower degree. The Dikonirt concentration we used caused a substantial the carotene quantity four days after spraying.

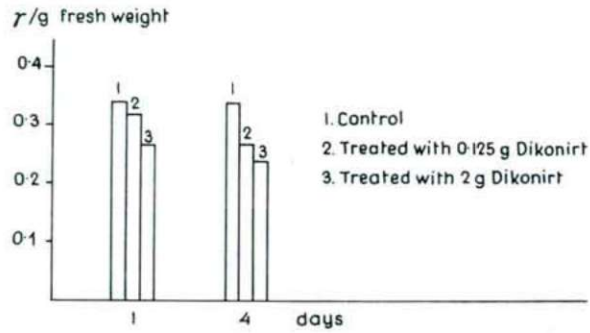

Fig. 3. Change of the quantity of carotene after spraying

The results obtained agree with the literary data at the post-emergent apply of Dikonirt. The damage is increasing if the concentration is higher like in case of the experiments of LIDER et al. (1966) carried out with simazine and diuron.

At the barley plant, the two sorts of Dikonirt concentration caused some destruction in the development of roots too in agreement with the statements of BINGHAM (1967). This may be connected with the alterations in the pigment content. Consequently, we could observe the change in the amount of pigments at the two sorts of Dikonirt concentration applied by us. According to the literary data, the pigment synthesis is inhibited by herbicides (HERRETT—BERTHOLD, 1965).

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Acta Biologica Szeged 16 (1—2), pp. 99—100 (1970)

BEITRÄGE ZUR ALGENFLORA DER NATRON- (SZIK-) GEWÄSSER UNGARNS II. KIESELALGEN AUS DEM TEICH ŐSZEZÉK

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(Eingegangen am 26. November 1968)

Einleitung

Die durch einen hohen Natriumcarbonat- bzw. Natriumbicarbonatgehalt charakterisierten flachen Stillgewässer der Ungarischen Tiefebene, die „Szik"-Teiche sind in den letzten vier Jahrzehnten wiederholt Objekte hydrobiologischer Forschung gewesen' So wurden auch die Algen, bzw. die Algenvegetation dieser Teiche in vielen Fällen sehr eingehend bearbeitet (s. die forschungsgeschichtliche Übersicht bei UHERKOVICH, 1968b), doch ist es auffallend, dass sich diese algologischen Studien meistens nur auf gewisse Algengruppen beschränken, also dass sie kein Gesamtbild über die Algenvegetation der untersuchten Teiche zu geben versuchen, ferner, dass sie — mit wenigen Ausnahmen — die Kieselalgen garnicht in Betracht ziehen.

Man kann wohl an Stillgewässern in bezug auf einzelne Algengruppen auch taxonomische und ökologische Studien mit speziellen Zielsetzungen ausführen, doch sind solche Studien für die Kenntnis der Gesamtdynamik eines Gewässers von weitem nicht so aufschlussreich, wie jene Studien, die durch die taxonomisch-ökologische Bearbeitung sämtlicher Algengruppen und gleichzeitig durch die zönologisch-quantitative Bearbeitung der Mengenverhältnisse über den ganzen Algenbestand, über die ganze Algenzönose eine limnologische Übersicht geben wollen.

Die Erforschung der Kieselalgen von Natronteichen der Ungarischen Tiefebene hat mit einer breit angelegten Arbeit von CHOLNOKY (1929) begonnen. Nach einer Zeitspanne von 30 Jahren ist eine weitere umfangreichere Arbeit über dieses Thema erchienen (SZEMES, 1959) und die dritte Arbeit, die sich mit den Kieselalgen der „Szik"-Teiche der Ungarischen Tiefebene beschäftigt, aber darüber hinaus auch die Gesamtheit der untersuchten Algenzönosen zu schildern versucht, erschien erst vor einigen Jahren (UHERKOVICH, 1965).

Wir wollen an dieser Stelle die Angaben über die Kieselalgen des Natronteiches Őszeszék zusammenfassen. Der Natronteich Őszeszék liegt nordwestlich von Szeged, im Donau-Theiss-Zwischenstromgebiet. Über die Limnophysiographie und Limnologie des Teiches, sowie über seine Planktonvegetation habe ich bereits berichtet (UHERKOVICH, 1968b). Die taxonomischen Einzelheiten seiner Algenflora plane ich in einer Schriftenreihe zu veröffentlichen; die Arbeit über die *Euglenophyteen* von Őszeszék ist bereits erschienen (UHERKOVICH, 1968a). Als zweite Arbeit dieser Reihe ist die hier vorgelegte gedacht.

Die Kieselalgen des Teiches Őszeszék

Die Zeitpunkte der betreffenden Probeentnahmen sind in der Aufzählung folgendermassen vermerkt = 1:5.5.1965; 2:6.9.1965; 3:1.12.1965; 4:25.3.1966; 5:13.6.1966; 6:19.9.1966; 7:5.12.1966; 8:10.3.1967; 9:10.5.1967; 10:13.10.1967. Die in Klammern gesetzten Zahlen beziehen sich auf die Ind./l-Werte des Organismus in der bezüglichen Probe.

Die aufgezählten Arten gelten nach der Literatur teils als limnische Arten, doch gibt es unter ihnen mehrere, die als limnischeuryhaline Arten oder sogar als Brackwasserorganismen zu betrachten sind. Jene Algen, die zu den beiden letzteren Gruppen gehören, werden in unserer Aufzählung mit "Ehl", bzw. „Brs" bezeichnet (vgl. REMANE und SCHLIEPER, 1958; UHERKOVICH, 1968b).

Für die Taxonomie und Ökologie der aufgezählten Kieselalgen geben die zitierten Arbeiten von CHOLNOKY, CLEVE—EULER, FLORIN, HALME und MÖLDER, HUBER—PESTALOZZI, HUSTEDT, KOLBE, SIEMINSKA, SZEMES gut verwendbare Stützpunkte.

1. *Amphiprora alata* KÜTZ. — Brs — 2,4,9 — 55—59 × 27—29 µ grosse Zellen, also etwas kleiner, als in den Literaturangaben.

2. *Amphiprora costata* HUST. — Brs — 2 (10 000) — 39—45 µ, in der Einschnürung 15 µ breite Zellen.

3. *Amphora commutata* GRUN. — Brs—Ehl — 1 (1000) — 50—58 × 22—23 µ grosse Zellen, typische Vertreter der Art. Ein typischer Salzwasserorganismus.

4. *Amphora lineolata* EHRBG. — Brs — 9 (1000) — 32—40 × 14—18 µ grosse, in Gürtelbandansicht linearelliptisch aussehende, zart gebaute Zellen, mit schwach konvexen Flanken und breit gestutzten Enden. Ein typischer Brackwasserorganismus, der in nennenswerten Individuenzahlen nur in echten Salzwasserbiotopen vorkommt. Ich fand diese Alge bloss zu einem Zeitpunkt (11.5.1967) bei mittelmässiger Salzkonzentration und in einer geringen Individuenzahl.

5. *Amphora veneta* (KÜTZ.) HUST. — Ehl — 1,2 — 20—27 × 9,5—11 µ Zellen, also verhältnismässig kleine Vertreter der Art. Nach CHOLNOKY (1929) kommt sie in unserem Gebiet fast ausschliesslich in salzhaltigen Gewässern vor.

6. *Anomoeoneis polygramma* (EHRBG.) CLEVE — Ehl — 1 (500), 4,7 (3000), 8,9 (1500), 10 (15 000) — Betrachte diese Alge nach CLEVE—EULER (1951—55, III. p. 201) als selbständige Art, also nicht als Varietät der Art *Anomoeoneis sphaerophora* (KÜTZ.) PFITZER. Eine limnischeuryhaline Kieselalge, die in richtigem Süsswasser nur selten vorkommt, bevorzugt Gewässer von mittelmässiger Salzkonzentration und dringt gelegentlich auch in Brackwasser vor. 92,5—150 × 27,5—37 µ grosse Zellen, die somit ttilweise grösser sind als die bisherigen Literaturangaben (bei CLEVE—EULER als Maximum 140 × 30 µ angegeben).

7. *Anomoeoneis sculpta* (EHRBG.) CLEVE var. *güntheri* O. F. M. — Ehl — 2 (20 000), 8,10 — 110—115 × 31—32,5 µ grosse Zellen; in der taxonomischen Deutung dieser Alge schliesse ich mich CLEVE—EULER an.

8. *Anomoeoneis sphaerophora* (KÜTZ.) PFITZER — Ehl — 1,4, 7 (6000), 8 (2000), 9 (2000), 10 (35 000) — 53—61 × 16,5—20 µ grosse Zellen. CHOLNOKY (1929) weist darauf hin, dass diese Alge in unserem Gebiet in grösseren Mengen nur in stärker konzentrierten Natronseen vorkommt.

9. *Caloneis amphisbaena* (BORY) CLEVE — Ehl — 1 (2000), 4,8 — 48—60 × × 16—20 µ grosse Zellen, demnach mittelmässig grosse und sogar kleine Vertreter der Art.

10. *Cyclotella meneghiniana* KÜTZ. — Ehl — 2 — Zellen 18—22 µ im Durchmesser. Ein halophiler Organismus, der aber auch im typischen Süsswasser anzutreffen ist. Nach CHOLNOKY (1929) kommt diese Alge in fast ellen natronhaltigen Gewässern der südlichen Ungarischen Tiefebene vor.

11. *Cyclotella* sp. — 1,2,4,9,10 — Meistens bei der quantitativen Bearbeitung der Proben vernommene Individuen, bei denen die spezifische Zugehörigkeit nicht festgestellt wurde.

12. *Cymbella affnis* KÜTZ. — 1,2 — 57—67 × 15—17 μ grosse Zellen.

13. *Cymbella cymbiformis* (KÜTZ.) van HEURECK — 1,4 — 52—58 × 13—14,5 μ grosse Zellen.

14. *Cymbella delicatula* KÜTZ. forma — Ehl? — 7 (5000), 8,10 — 21—24 × × 3,5—4,5 μ grosse Zellen. Die Art ist besonders an überrieselten Felsen in Gebirgen verbreitet. Die hier angetroffene, verhältnismässig kleine Form ist vielleicht ein Ehl-Organismus.

15. *Cymbella gracilis* (RABENH.) CLEVE var. *schmidtii* CLEVE — 4 — 25—26,5 × 6 μ grosse Zellen, nur in sehr wenigen Individuen angetroffen.

16. *Cymbella laevis* NAEG. — 7,8 (6000), 9 (2000) — 26—33 × 6—7,5 μ grosse Zellen.

17. *Cymbella prostrata* (BERKELEY) CLEVE — Ehl — 38—42 × 13—14,5 μ grosse Zellen.

18. *Cymbella pusilla* GRUN. — Brs—Ehl — 1 (500), 2 — 23—40 × 4,5—6 μ grosse Zellen. Die Polen der Zellen stumpf gerundet, ein wenig vorgezogen und ventral gesenkt. Die Art kommt sowohl im brackigem als auch in kalkreichem Wasser vor, bevorzugt also Gewässer von höheren Salzkonzentrationen. Ihre Anwesenheit im Teiche Őszeszék konnte ich einwandfrai nur zu zwei Zeitpunkten (5.5. 1965, 6.9.1965) feststellen. In einer Probe war die Art mit 500 Ind./l vetreten, in den weiteren Proben kam sie nur vereinzelt vor.

19. *Diatoma elongatum* AGH. — Ehl — 1 (1000), 4,9 (64 000) — 60—85 × 2,5—3 μ grosse Zellen; in einer Probe (11.5.1967), Schilfgürtel) mit grosser Individuenzahl vertreten.

20. *Diatoma vulgare* BORY — 7 (2000), 9 (2000) — 35—45 × 10—11 μ grosse Zellen.

21. *Epithemia argus* KÜTZ. var. *intermedia* (HILSE) A. MAYER — Ehl — 4 — 48—51 × 10—11 μ grosse Zellen.

2. *Epithemia sorex* KÜTZ. — Brs — Ehl — 9 (2000), 10 (5000) — 38—42 × 10 μ grosse Zellen.

23. *Epithemia turgida* (EHRBG.) KÜTZ. — Ehl — 2,8,9 — 58—65 × 12—13 μ grosse, also verhältnismässig kleine Zellen. Bereits CHOLNOKY (1929) beobachtete diese Art in vielen Natrontümpeln der Ungarischen Tiefebene.

24. *Epithemia zebra* (EHRBG.) KÜTZ. — 10 —32—40 × 8—10 μ grosse Zellen.

25. *Epithemia zebra* var. PORCELLUS (KÜTZ.) GRUN. — 9 —30—35 × 7—9 μ grosse Zellen, sehr spärlich vorkommend.

26. *Eunotia lunaris* (EHRBG.) GRUN. var. *capitata* GRUN. — 4 — 76—79 × × 4—4,5 μ grosse Zellen in wenigen Individuen beobachtet.

27. *Fragilaria capucina* DESMAZ. — 1 — 30—38 × 2 μ grosse Zellen zu kurzen Bändern verbunden. Eine typische limnische Art, nur in einer Probe und in sehr spärlicher Individuenzahl beobachtet.

28. *Gomphonema acuminatum* EHRBG. var. *pantocsekii* CLEVE forma — 4 — 50—54 × 10 μ grosse Zellen, sehr selten.

29. *Gomphonema olivaceum* (LYNGB.) KÜTZ. var. *calcarea* CLEVE — Ehl — 8,9 (3000) — 41—44 × 8,5—9 μ grosse Zellen.

30. *Gomphonema parvulum* (KÜTZ.) GRUN. — 2 — 30,5—32 × 8 μ grosse Zellen, also etwas grösser als die Angaben bei Hustedt (dort als Maximum 30 × 7 μ angegeben).

31. *Hantzschia amphioxys* (EHRBG.) GRUN. f. *capitata* O. MÜLL. — 4 — 75—81 μ lange Zellen, nur in wenigen Individuen beobachtet; nach CHOLNOKY (1929) euryhalin.

32. *Mastogloia grevillei* W. SMITH — 6 — 48—54 × 13,5—14,5 μ grosse Zellen, die breiter sind als in der Literaturangaben.

33. *Navicula cincta* (EHRBG.) KÜTZ. — Ehl — 7 (11 000), 8 (1000), 10—32—39 × × 6 μ grosse Zellen.

34. *Navicula cryptocephala* KÜTZ. var *veneta* (KÜTZ.) GRUN. — 10 — 23—38 × × 6,5 μ grosse Zellen, spärliches Vorkommen.

35. *Navicula cuspidata* KÜTZ. — 2,8 — 117—132 × 30—35 μ grosse Zellen.

36. *Navicula cuspidata* var. *ambigua* (EHRBG.) CLEVE — 7,8 — 50—112 × 14—30 μ grosse Zellen.

37. *Navicula graciloides* A. MAYER — 8 — 27—29 × 5,5—6 μ grosse, also etwas kleinere Zellen als die Angaben bei Hustedt (dort 30 × 6 μ als Minimum angegeben).

38. *Navicula hungarica* GRUN. — Ehl? — 2 — 18—22 × 6—6,5 μ grosse Zellen, wahrscheinlich Ehl; diese Behauptung wird auch durch die Beobachtungen von CHOLNOKY (1929) unterstützt.

39. *Navicula oblonga* KÜTZ. — Ehl — 4 — 120—128 × 15—17 μ grosse Zellen. Neben Süsswasser auch in schwach salzigem Wasser.

40. *Navicula rhynchocephala* KÜTZ. — Ehl — 6 — 65—68 × 15,5—16 μ gorsse Zellen, grösser als bei Hustedt (dort Maximalgrösse 60 × 13 μ).

41. *Navicula tuscula* (EHRBG.) GRUN. — 10 (45 000) — 60—68 × 20—21 μ grosse Zellen, ist nur in einer Probe vorgekommen, aber dort in grosser Individuenzahl.

42. *Navicula sp.* — 2,3,10 — Bei der quantitativen Bearbeitung der Proben vernommene *Navicula*-Individuen, ohne nähere Bestimmung.

43. *Nitzschia acicularis* W. SMITH — 1 (2500), 4,9 (9000) — 60—72 × 3 μ grosse Zellen.

44. *Nitzschia amphibia* GRUN. — 2,8,10 — 23—26 × 3,5—4 μ grosse Zellen, vereinzeltes Vorkommen.

45. *Nitzschia apiculata* (GREGORY) GRUN. — Brs — 7 (1000), 10 (1000) — 35—47 × 7—9 μ grosse Zellen, mit verengter Zellmitte und etwas vorgezogenen, spitz gerundeten Polen. Eine Salzwasserform, kommt sowohl im Brackwasser als auch in salzhaltigen Gewässern des Binnenlandes vor. Habe die Art zu zwei Zeitpunkten und in geringer Individuenzahl beobachtet.

46. *Nitzschia capitellata* HUST. — Ehl — 1 (1000), 2,3,4,6,7 (16 000), 8 (32 000), 9 (6000), 10 (85 000) — 49—61 × 4—5 μ grosse, linear-lanzettliche Zellen mit schmal vorgezogenen, mehr-weniger kopfig gerundeten Polen. Ein typisch-euryhaliner Organismus, der sich, mit einer einzigen Ausnahme, in meinen sämtlichen Proben und meistens in grösserer Individuenzahl vernommen liess. Eine nennenswerte Vermehrung dieser Art ist — meiner Beobachtung nach — an Salzgewässern gebunden.

47. *Nitzschia closterium* (EHRBG.) W. SMITH — Brs — 1 (500) — 62—85 × 2,5—3 μ grosse Zellen. Diese ausgeprägte Salzwasserform ist nur in einer Probe vorgekommen.

48. *Nitzschia communis* RABENH. — 7 (2000) — 35—41 × 5 μ grosse Zellen.

49. *Nitzschia commutata* GRUN. — Brs—Ehl — 4 — 51—57 × 8—9 μ grosse Zellen.

50. *Nitzschia dissipata* (KÜTZ.) GRUN. — 8 (560 000) — 38—52 × 5—5,5 μ grosse Zellen, wurde nur in einer Probe, aber diesmal in grosser Individuenzahl beobachtet.

51. *Nitzschia frustulum* (KÜTZ.) GRUN. — Brs — Ehl — 1,2 (23000), 4,6,7 (3000), 8,9 (9000), 10 — 38—50 × 3,5—5 μ lange, linear-schmallanzettliche Zellen mit keilförmigen, mehr—weniger zugespitzten Zellenden. Kommt besonders in leicht

brackigem Wasser des Binnenlandes vor, findet sich aber hier und da auch im Süsswasser. Ich fand die Art zu sieben verschiedenen Zeitpunkten im Teiche Ószeszek, öfters durch bedeutende Individuenzahlen vertreten.

52. *Nitzschia frustulum* var. *subsalina* HUST. — Brs — Ehl — 7 (2000) 32—42 × 4 μ grosse Zellen.

53. *Nitzschia gandersheimiensis* KRASSKE — Brs — 10 — 62—65 × 4—4,5 μ grosse Zellen. Ein typischer Salzwasserorganismus; in einer Probe mit wenigen Individuen vertreten.

54. *Nitzschia gracilis* HANTZSCH — 7 (500) — 80—88 × 2,5—3 μ grosse Zellen.

55. *Nitzschia hungarica* GRUN. — Ehl — 1 (1000) — 72—85 × 7,7,5 μ grosse Zellen; ein häufiger Organismus schwach salziger Gewässer, wurde im Teiche Őszeszék nur zu einem Zeitpunkt beobachtet. Nach CHOLNOKY (1929) ist diese Alge besonders in den weniger konzentrierten natronhalt igen Gewässern anzutreffen

56. *Nitzschia kützingiana* HILSE — 1 (4000), 2,5 — 22,5—32,5 × 3,5—4 μ grosse Zellen, Zellänge etwas grösser als die üblichen Literaturangaben.

57. *Nitzschia linearis* W. SMITH — 2,10 — 88—102 × 5,5 μ grosse Zellen.

58. *Nitzschia palea* (KÜTZ.) W. SMITH — 1 (1000), 3,4,5,7 (1000), 8,10 — 38—45 × 4,—4,5 μ grosse Zellen. Die geringen Individuenzahlen dieser Art zeugen dafür, dass in diesem Teich weder eine richtige Eutrophierung noch eine nennenswerte Saprobisierung stattfindet.

59. *Nitzschia paleacea* GRUN. — 1,2,3,7,8 (32 000), 10 (39 000) — 26—28 × × 2,5—3,5 μ grosse Ztllen.

60. *Nitzschia sigma* (KÜTZ.) W. SMITH — Brs — 6 — 120—180 × 11—12 μ grosse Zellen. Typische Salzwasserform; wurde im Teiche Őszeszék zu einem Zeitpunkt und in wenigen Individuen angetroffen.

61. *Nitzschia sigma* var. *calusii* (HANTZSCH) GRUN. — Brs — 6 — 30—34 × 4 μ grosse Zellen; in einer Probe durch sehr wenige Individuen vertreten.

62. *Nitzschia sigmoidea* (EHRBG.) W. SMITH — 4,8 — 110—180 × 6—7 μ grosse Zellen.

63. *Nitzschia sigmoidea* var. *armoricana* (KÜTZ.) GRUN. — 9 — 230—245 × 7 μ grosse Zellen; nur einige Individuen beobachtet.

64. *Nitzschia spectabilis* (EHRBG.) RALFS — Brs—Ehl — 2 — 308—340 × 14—15 μ grosse Zellen, spärliches Vorkommen in einer Probe.

65. *Nitzschia thermalis* KÜTZ. — 4 — 78—85 × 8,5 μ grosse Zellen; spärliches Vorkommen in einer Probe.

66. *Nitzschia thermalis* var. *minor* HILSE — 4,8 — 50—55 × 7—8 μ grosse Zellen.

67. *Nitzschia vitrea* NORMAN forma — Brs — 1 — 120—160 × 13—14 μ grosse Zellen: eine breite plumzellige Form. Typischer Salzwasserorganismus, ist nur in einer Probe vorgekommen.

68. *Pinnularia divergens* W. SMITH var. *Minor* A. S. — 4 — 89—97 × 15—16 μ grosse Zellen.

69. *Pinnularia gibba* EHRBG. — 2,8,9 — 97—118 × 15—18,5 μ grosse Zellen, ziemlich häufig in den aufgezählten Proben.

70. *Pinnularia microstauron* (EHRBG.) CLEVE — 4 — 34—40 × 9—10 μ grosse Zellen; vereinzelt.

71. *Pinnularia microstauron* var. *brébissonii* (KÜTZ.) HUST. — 7.8 — 33,5—42,5 × × 10—11 μ grosse Zellen, spärlich vertreten.

72. *Pinnularia pulchra* ÖSTRUP — 4 — 52—58 × 10 μ grosse Zellen, vereinzelt.

73. *Pinnularia viridis* (NITZSCH) EHRBG. — 4,10 — 70—85×13—18 μ grosse Zellen.

74. *Rhopalodia gibba* (EHRBG.) O. MÜLL. — 2,9 (1000) — 65—80×22—24 μ grosse Zellen.

75. *Rhopalodia gibba* var. *ventricosa* (EHRBG.) GRUN. — 2,5, 7 (3000), 10 — 52—56×28 μ grosse Zellen.

76. *Rhopalodia gibberula* (EHRBG.) O. MÜLL. — Brs — 2,4,5, 7 (1000) — 34—38×16—21 μ grosse Zellen; typische Salzwasserform, nach CHOLNOKY (1929) eine typische Bewohnerin der Natronteiche der Ungarischen Tiefebene. Ihre Anwesenheit wurde aus mehreren Proben festgestellt.

77. *Rhopalodia gibberula* var. *minuens* O. MÜLL. — Brs — 4,7 — 30—32× ×10—10,5 μ grosse Zellen; diese ebenfalls typische Salzwasserform kommt etwas seltener vor als die vorhergehende Art.

78. *Scoliopleura peisonis* GRUN. — Brs—Ehl — 4 — 48×—67×13—16 μ grosse Zellen, Raphe stark S-förmig gebogen. Ein eigenartiger Organismus der brackischen Binnenseen.

79. *Stauroneis anceps* EHRBG. — 5,6,7,8 (4000), 9 (2000), 10 — 48—62× ×12—17,5 μ grosse Zellen, ziemlich häufig. Nach CHOLNOKY (1929) kann diese Alge auch recht konzentrierten Salzgehalt ertragen.

80. *Stauroneis anceps* var. *hyalina* BRUN et PERAG. — 2,4,5,7 (2000), 8 (1000) — 33—36,5×8 μ grosse Zellen.

81. *Surirella ovalis* BRÉB. — 8,9 — 102—128×55—60 μ grosse Zellen.

82. *Surirella peisonis* PANT. var. pyriformis PANT. — Brs—Ehl — 1 (500), 4,7,9 — 78—84×51—59 μ grosse, birnenförmige Zellen. Taxonomische Deutung dieser Alge erfolgte nach der ursprünilichen Auffussung von Pantocsek.

83. *Surirella peisonis* var. *pyriformis* f. *minima* UHERKOVICH — Brs—Ehl — 1,4,7,8,10 — 50—70×42—58 μ grosse, birnenförmige Zellen. Die Form f. minima wurde aus einem anderen Natronteich der Ungarischen Tiefebene beschrieben (Kunfehérto, UHERKOVICH, 1965). Dieser Organismus stimmt mit der von PANTOCSEK (1. c. 123, Fig. 302) beschriebenen Variation überein, nur weist er entschieden kleinere Dimensionen auf. (Die Varietät ist bei PANTOCSEK mit den Zelldimensionen 81,5— —83×58,3—59 μ gekennzeichnet.) Die taxonomische Einreihung, so die spezifische Absonderung der Art *Surirella peisonis* von *Surirella ovalis* und das Aufrechthalten der Varietät var. *pyriformis* erörterte ich in der schon zitierten Arbeit (UHERKOVICH, 1965).

84. *Synedra actinastroides* LEMM. — 4 — 38—42×2,5 μ grosse Zellen büschelige, sternförmige, schwebende Kolonien bildend. Im Teiche Őszeszék sehr selten.

85. *Synedra affinis* KÜTZ. — Ehl — 1 (8500), 4,7,9 (3000) — 68—75×2,5—3 μ grosse Zellen.

86. *Synedra pulchella* (RALFS) KÜTZ. — Brs—Ehl — 4,7 (21 000), 8 (8000), 9 (5000) — 45—97×5—7,5 μ grosse, lanzettliche Zellen, mit stumpf gerundeten oder köpfigen Polen. Zentralarea mit mehr-weniger verdicktem Rand, wodurch ein Pseudoknoten entsteht. Vorzugsweise im Brackwasser verbreitet, aber auch im Süsswasser auftretend. Eine nennenswerte Vermehrung dieser Art findet im allgemeinen nur im Wasser von höheren Konzentrationen statt. CHOLNOKY (1929) fand die Art im Gebiet stets in solchen Gewässern, die mehr oder minder salzhaltig waren. Ich selber fand die Art, als auch ihre Varietät var. *lanceolata* und deren Form f. *constricta* (s. weiter unten) in mehreren Proben; in einigen Proben war die Art sogar durch grössere Individuenzahlen vertreten.

Tabelle I

DIE KIESELALGEN DES TEICHES ÖSZESZÉK IN HALOBIENSYSTEM

Limn	Ehl	Brs–Ehl	Brs
Cymbella affinis	Amphora veneta	Amphora commutata	Amphiprora alata
Cymbella cymbiformis	Anomoeoneis polygramma	Cymbella pusilla	Amphiprora costata
Cymbella delicatula	Anomoeoneis sculpta var. güntheri	Epithemia sorex	Amphora lineolata
Cymbella gracilis var. schmidti	Anomoeoneis sphaerophora	Nitzschia commutata	Nitzschia apiculata
Cymbella laevis	Caloneis amphisbaena	Nitzschia frustulum	Nitzschia closterium
Diatoma vulgaris	Cyclotella meneghiana	Nitzschia frustulum var. subsalina	Nitzschia gandersheimiensis
Epithemia zebra	Cymbella prostrata	Nitzschia spectabilis	Nitzschia sigma
Epithemia zebra var. parcellus	Diatoma elongatum	Scoliopleura peisonis	Nitzschia sigma var. clausii
Eunotia lunaris var. capitata	Epithemia argus var. intermedia	Surirella peisonis var. pyriformis	Nitzschia vitrea
Fragilaria capucina	Epithemia turgida	Surirella peisonis var. pyriformis f. minima	Rhopalodia gibberula
Gomphonema acuminatum var. pantocsekii	Gomphonema clivaceum var. calcarea	Synedra pulchella	Rhopalodia gibberula var. minuens
Gomphonema parvulum	Navicula cincta	Synedra pulchella var. lanceolata	Surirella ovalis
Hantzschia amphioxys f. capitata	Navicula oblonga	Synedra pulchella var. lanceolata f. constricta	(12 Taxa)
Mastogloia grevillei	Navicula rhincocephala	(13 Taxa)	
Navicula cryptocephala var. veneta	Nitzschia capitellata		
Navicula cuspidata	Nitzschia hungarica		
Navicula cuspidata var. ambigua	Synedra affinis		
Navicula graciloides	(17 Taxa)		
Navicula hungarica			
Navicula tuscula			
Nitzschia acicularis			
Nitzschia amphibia			
Nitzschia communis			
Nitzschia dissipata			
Nitzschia gracilis			
Nitzschia kützingiana			
Nitzschia linearis			
Nitzschia palea			
Nitzschia paleacea			
Nitzschia sigmoidea			
Nitzschia sigmoidea var. armoricana			
Nitzschia thermalis			
Nitzschia thermalis var. minor			
	Limn (forts.)		
	Pinnularia divergens var. minor		
	Pinnularia gibba		
	Pinnularia microstauron		
	Pinnularia microstauron var. brébissonii		
	Pinnularia pulchra		
	Pinnularia viridis		
	Rhopaloida gibba		
	Rhopaloida gibba var. ventricosa		
	Stauroneis anceps		
	Stauroneis anceps var. hyalina		
	Synedra actinastroides		
	Synedra ulna var. biceps		
	Synedra vaucheriae		
	(46 Taxa)		

87. *Synedra pulchę lla* var. *lanceolata* O'MEARA — Brs—Ehl — 7 — 38—52 × 9,5—10 µ grosse Zellen; selten.

88. *Synedra pulchella* var. *lanceolata* f. *constricta* HUST. — Brs—Ehl — 7 (1000), 8 — 36—42 × 7—9 µ grosse Zellen.

89. *Synedra ulna* (NITZSCH) EHRBG. var. *biceps* (KÜTZ.) HUST. — 4,8 (2000), 9 (5000) — 140—185 × 5—6 µ grosse Zellen.

90. *Synedra vaucheriae* KÜTZ. — 1,5 — 18—26 × 2,5 µ grosse Zellen, mit einseitiger Verdickung in der Zellmitte Selten.

Tabelle II

DER KIESELALGEN – ANTEIL DER PHYTOSESTONBESTÄNDE IM TEICHE ÖSZESZÉK

	5. 5. 1965				6. 9. 1965				1. 12. 1965				13. 6. 1966		13. 9. 1966		5. 12. 1966				10. 3. 1967		11. 5. 1967				13. 10. 1967	
	offenes Wasser (O-Ufer)		offenes Wasser (W-Ufer)		offenes Wasser (N-Ufer)		Schilfgürtel		offenes Wasser		Schilfgürtel		offenes Wasser		offenes Wasser		offenes Wasser		Schilfgürtel		offenes Wasser		offenes Wasser		Schilfgürtel		offenes Wasser	
	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%	Ind./l	%
Amphiprora costata							10000	0,78																				
Amphora commutata			1000	1,10																					1000	0,42		
Amphora lineolata	+						+																					
Amphora veneta	+		500	0,60	+		+												3000	0,65	+		+		1000	0,42	15000	1,09
Anomoeoneis polygramma			500	0,60																	+						+	
Anomoeoneis sculpta var. guntheri							20000	1,55															+		2000	0,84	35000	2,54
Anomoeoneis sphaerophora	+		+														+		6000	1,29	2000	0,60	+		2000	0,84		
Caloneis amphisbaena			2000	2,39																	+							
Cyclotella – Arten	+		+		+		100000	7,78									1000	2,60	3000	0,65	3000	0,60			11000	4,63		
Cymbella delicatula																	+		5000	1,08	+						+	
Cymbella laevis																	+		+		6000	1,75	1000	5,0	2000	0,84		
Cymbella pusilla	+		500	0,60	+		+																					
weitere *Cymbella* - Arten			3500	4,19																					64000	26,89		
Diatoma elongatum	1000	0,69	+																2000	0,43					+			
Diatoma vulgare																									2000	0,84	5000	0,36
Epithemia sorex																					+				3000	1,26		
Gomphonema olivaceum var. calcarea																			11000	2,37	1000	0,30					+	
Navicula cincta																											45000	3,26
Navicula fuscula							140000	10,90	+		+																+	
weitere *Navicula* - Arten																									8000	3,38		
Nitzschia acicularia			2500	2,99															2000	0,43					1000	0,42		
Nitzschia apiculata									+		+				+		+		16000	3,45	32000	8,58	2000	10,0	6000	2,52	85000	6,16
Nitzschia capitellata			1000	1,20	+		+																					
Nitzschia closterium			500	0,60															2000	0,43								
Nitzschia communis																					560000	16,76						
Nitzschia dissipata																	+		3000	0,65	+				19000	7,99	+	
Nitzschia frustulum	+		+		+		230000	17,88							+				2000	0,43								
Nitzschia frustulum var. subsalina																	500	1,30										
Nitzschia gracilis																												
Nitzschia hungarica	+		1000	1,20									+															
Nitzschia kuetzingiana			4000	4,79	+		+						+				+		1000	0,21	+						+	
Nitzschia palea	500	0,34	1000	1,20					+		+		+				+		+		32000	9,58			39000	16,34		
Nitzschia paleacea	+		+		+		+		+		+																	
Nitzschia vitrea forma			500	0,60																								
weitere *Nitzschia* - Arten							100000	7,78																	2000	0,84		
Pinnularia - Arten							40000	3,11																	1000	0,42		
Rhopalodia gibba																											+	
Rhopalodia gibba var. ventricosa					+		+						+						3000	0,65								
Rhopalodia gibberula					+		+						+				+		1000	0,21								
Stauroneis anceps													+		+		+		+		4000	1,20			2000	0,84	+	
Stauroneis anceps var. hyalina					+		+						+				+		2000	0,43	1000	0,30						
Surirella peisonis var. pyriformis	+		500	0,60													+		+				+		3000	1,26		
Synedra affinis	8500	5,84	1500	1,79													+		+						7000	2,94		
Synedra pulchella																	2000	5,19	21000	4,53	8000	2,39	5000	25,0				
S. pulchella var. lanceolata f. constricta																	1000	2,60	+		+							
Synedra ulna var. biceps																					2000	0,60			5000	2,10		
übrige Bacillariophyceae - Arten	9000	6,19	15500	18,56			170000	13,22									6500	16,88	19000	4,10	49000	14,68	2000	10,0	12000	5,04	90000	6,52
sämtliche Bacillariophyceae	19000	13,06	36500	43,71	7500	0,60	810000	62,00	60000	0,38	540000	2,40	400	7,69	800	8,51	11000	28,57	102000	21,99	197000	58,98	10000	50,0	192000	80,68	275000	19,93
sämtliche Algen	145000	100%	83500	100%	1247500	100%	1386000	100%	15640000	100%	22540000	100%	5100	100%	9400	100%	38500	100%	464000	100%	334000	100%	20000	100%	238000	100%	1380000	100%
Anteil der Salzwasserorganismen (Ehl, Bra-Ehl, Bra Arten) in der Zönose	112000	77,24	72000	86,36	557000	44,69	336000	26,90	15410000	98,11	21500000	95,38	800	11,54	3400	36,17	26000	67,53	402000	84,79	759000	77,53	10000	50,0	181000	67,65	220000	15,95

Zusammenfassende Betrachtungen

Es wurde in dem Teich Őszeszék die Anwesenheit von insgesamt 90 Kieselalgentaxa festgestellt. Davon waren 2 Taxa näher nicht bestimmt. Unter den 88 Taxa gelten 46 als limnische, 17 als limnische-euryhaline, 13 als euryhalin-brackische und 12 als brackische Organismen. Es gelten also fast die Hälfte der angetroffenen Taxa als mehr-weniger ausgeprägte Salzwasserorganismen. Besonders interessant ist das Vorkommen von ausgesprochenen Brackwasserorganismen (s. Tabelle I).

Der Kieselalgen-Anteil in der mengenmässigen Zusammensetzung des Phytosestons war zu drei Zeitpunkten nur gering, so am 1. 12. 1965: 0,38, bzw. 2,40% des Gesamtindividuenwertes, am 13. 6. 1966: 7,69% und am 19. 9. 1966: 8,51%. Doch scheint dieser geringe Kieselalgen-Anteil in den Phytosestonbeständen von Őszeszék eher eine Ausnahme zu sein, den in allen übrigen beobachteten Fällen war dieser Anteil weit grösser, zwischen 13,06% und 80,68% der Gesamtalgenbevölkerung schwankend.

Die untersuchten Phytosestonpopulationen (s. Tabelle II) bestanden zu 11,54—95,38% aus mehr-weniger ausgeprägten Salzwasserorganismen. Der Anteil solcher Organismen im Gesamtseston war durchschnittlich um 55%. Die verhältnismässig hohen Salzkonzentrationen (Na^+ 248,8—947,6 mg/l, Mg^{++} 37,3—84,0 mg), HCO_3^- 634—1930 mg/l usw. vgl. noch dazu die Angaben bei UHERKOVICH, 1968 b) ermöglichen also im Teiche Őszeszék das Gedeihen einer an Salzwasserorganismen im durchschnitt reicher Algen-vegetation.

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Acta Biologica Szeged 16 (1—2), pp. 109—115 (1970)

NEUERE ANGABEN ZUR PUBERTÄT DER TIEFLÄNDISCHEN MÄDCHEN

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(Eingegangen am 1. April, 1969.)

Einführung

Im Laufe der systematischen Untersuchung des körperlichen Wachstums der südungarischen Kinder ist unsere Aufmerksamkeit auf eine der charakteristischsten Indexeigenschaften der Mädchen im Pubertätsalter, auf die Menarche, gerichtet worden.

Es ist leider ziemlich schwer, die Zeit der Menarche mit Genauigkeit festzustellen, mit der Hilfe von Fragebogen kann aber das Problem technisch leicht gelöst werden. Da diese Erscheinung in hohem Masse von anderen Faktoren (wie Erblichkeit, geographische Umgebung, Zahl der Geschwister, Jahreszeit, Urbanisation, Eiweissgehalt der Nahrungsmittel, Pigmentation usw.) abhängt, (THOMA, 1960; VALŠIK, 1960; BOTTYÁN, etc., 1963; FARKAS, 1963; FARKAS, 1964; VALŠIK—BERNATOVÁ 1964), kann sie nicht als spezifische Indexeigenschaft betrachtet werden. Angaben von hoher Genauigkeit lassen sich mit der Hilfe der Fragebogen-Methode sammeln, eine solche Untersuchung bedeutet der untersuchten Person keine Gefahr, d. h. die Methode entspricht jedenfalls dem Innozenzprinzip (JUVANCZ, 1965).

Bereits im Laufe unserer früheren Angabensammlungen wurde die Methode von THOMA angewendet (THOMA, 1960), es wurde über unseren Informationen berichtet (FARKAS, 1962). Auf Grund der Angabensammlungen der letzten Jahre konnte auch die Landesmediane mit grosser Wahrscheinlichkeit festgestellt werden (BOTTYÁN, etc., 1963), obwohl dieses Ergebnis nicht aus repräsentativer Stichprobe gewonnen worden ist. Es soll ohne Zweifel hervorgehoben werden, dass vor allem THOMA in Ungarn auf diesem Gebiet eine bahnbrechende Arbeit geleistet hat. In seinem Beitrag lenkte er die Aufmerksamkeit auf die richtige Analysierungsweise dieser Indexeigenschaft (THOMA, 1960). Bei unserem vorliegenden Beitrag wurde die Methode von WEBER (WEBER, 1961) in der Auswertung der Angaben neben den Hinweisen von THOMA in Betracht genommen. Auf den Fragebogen waren unsere Fragen deutlich genug formuliert, und so bekamen wir Informationen von den Mädchen nicht nur bezüglich des Auftretens dieser Erscheinung, sondern im Falle der Bejahung auch bezüglich des Datums (Jahr, Monat, Tag).

Die Koinzidenz von Geburtsmonat und Menarchemonat wurde von SIMELL (SIMELL, 1951) entdeckt, später haben auch andere an grösseren Stichproben die Häufigkeitsteilung dieser Entdeckung festgestellt (VALŠIK—STUKOVSKÝ, 1963). Auch bei einheimischem Material gelang es uns, den Zusammenhang zu registrieren (FARKAS, 1962; 1964).

Auch die jahreszeitliche Schwankung der Menarche liess sich nachweisen (VALŠIK, 1934; ENGLE-SHELESNYAK, 1934; FARKAS, 1962).

Unser Untersuchungsmaterial war auch zur Beobachtung dieser Erscheinungen geeignet.

Material und Methode

Die Wichtigkeit der Erscheinung, weiterhin die sehr wechselvollen Gründe ihres Auftretens haben uns bewegt, am 10., 14., 15., 23—28., 31. Oktober und 3., 4., 10. November 1964 auch in Kecskemét Angaben zu sammeln.

Diese Stadt liegt in Ungarn auf dem Donau-Theiss-Zwischenstromland und ist die siebentgrösste Stadt des Landes. Die Mehrheit der Bewohner ist in der Industrie oder anderswo beschäftigt, die Zahl der landwirtschaftlichen Arbeiter ist minder. Die Bewohnerzahl betrug am Anfang des Jahres 1964 beinahe 72000 (Bács-Kiskun etc., 1965). Beachtet man, dass die Stadt auf jenem Gebiet des Landes liegt, wo die Proportion der Kinder 24—26% beträgt, kann die Zahl der Schüler um 18000 sein.

1964 sammelten wir in dieser Stadt mit Durchschnittsuntersuchung (einmal vorgenommene Angabensammlung) anthropometrische Angaben von etwa 3500 Schülern. Die Fragebogen zur Menarche-Untersuchung liessen wir im Rahmen dieser Untersuchung ausfüllen. Nimmt man die oben erwähnten Zahlen in Betracht, ist es äuserst wahrscheinlich, dass die nachfolgend angeführten Ergebnisse für die in der Stadt lebenden Mädchen als charakteristisch zu betrachten sind.

Untersuchungsergebnisse

Die 1. Tabelle berichtet über die Angabensammlung in Kecskemét, über die Proportionen der menstruierenden und der nicht menstruierenden Mädchen in halbjährigen Altersgruppen. Daraus ist ersichtlich, dass die erste Blutung bis zum Zeitpunkt der Angabensammlung bei 41,4% der befragten 710 Mädchen aufgetreten ist. Dieses Vorkommen ist im Vergleich zu unseren bisherigen Untersuchungen gleichen Charakters wesentlich niedriger. Die Erscheinung konnte bei den Mädchen aus Orosháza (die Gegend links der Theiss) in 54% (FARKAS, 1963), bei den Mädchen aus Szeged (Südungarn) in 63% (FARKAS, 1962), bei den Mädchen aus Pécs (Transdanubien, Gebirgsland) in 65% (FARKAS, 1964) beobachtet werden. Obwohl die Grösse der einzelnen Stichproben unterschiedlich war, ist es auffallend, dass das prozentmässige Vorkommen der Menarche in den Stichproben von Ostungarn nach Westungarn, von der Tieflandsgegend nach dem Gebirgsland gehend erheblich zunimmt.

Die erste Blutung trat bei den befragten Mädchen mit 9 Jahren 1 Monat 14 Tagen am frühesten und mit 15 Jahren 8 Monaten 2 Tagen am spätesten auf.

Die Menarche-Mediane wurde mit PROBIT-Methode bestimmt. Sie ist auf der 2. Tabelle gezeigt. Bei der Bestimmung der Mediane wurde der niedrigere Wert der 15 jährigen ausser Acht gelassen, weil die prozentmässige Erscheinung der Menarche unter normalen Umständen bei der fraglichen Gruppe nicht niedriger als die der 14,5 Jährigen sein kann. Diese Verminderung steht mit der geringen Zahl der 15 Jährigen im Zusammenhang. Die Regressionsgerade erhöht sich steil der empirischer Probiten entlang, ihre Gleichung lautet: $y = 0{,}832\ x - 5{,}85$. Die Gleichung wies eine grosse Ähnlichkeit mit der Gleichung der Regressionsgerade auf die bei der

Tabelle 1. Die Verteilung der menstruierenden und nicht-menstruierenden Mädchen laut Altersgruppen

Altersgruppe	Menstruieren		Nicht menstruierenden		Zusammen
	Fall n	% p	Fall n	% p	
10,5	—	—	1	100,0	1
11	1	4,5	21	95,4	22
11,5	4	3,7	104	96,2	108
12	20	18,6	87	81,3	107
12,5	38	37,6	63	62,3	101
13	54	42,1	74	57,8	128
13,5	74	63,2	43	36,7	117
14	67	78,8	18	21,1	85
14,5	21	87,5	3	12,5	24
15	6	85,7	1	14,2	7
15,5	6	100,0	—	—	6
16	3	75,0	1	25,0	4
Totalwert	294	41,4%	416	58,6%	710

Tabelle 2. Die wichtigeren Parameter der Probit-Regressionsgleichung des Lebensjahres und der Menarche

x	n	r	p	Y_e	Y	P	nP/100 = = nP	r—nP
15	7	6	85,7	6,06	6,63	94,8	6,6	—0,6
14,5	24	21	87,5	6,15	6,21	88,7	21,2	—0,2
14	85	67	78,8	5,79	5,80	78,7	66,9	0,1
13,5	117	74	63,2	5,33	5,38	64,7	75,7	—1,7
13	128	54	42,1	4,80	4,97	48,7	62,3	—8,3
12,5	101	38	37,6	4,68	4,55	32,5	32,8	5,2
12	107	20	18,6	4,10	4,13	19,1	20,4	—0,4
11,5	108	4	3,7	3,21	3,72	10,0	10,8	—6,6
11	22	1	4,5	3,30	3,30	4,4	9,7	—8,7
	699	285						

$\frac{(r-nP)^2}{nP(1-P)}$	w	n·w	n·w·x	n·w·x^2
1,059	0,23753	1,66271	24,94065	374,10975
0,017	0,37031	8,88744	128,86788	1868,58426
0,001	0,50260	42,72100	598,09400	8373,31600
0,108	0,60052	70,26084	948,52134	12805,03809
2,156	0,63662	81,48736	1059,33568	13771,36384
1,221	0,60052	60,65252	758,15650	9476,95625
0,010	0,47144	50,44408	605,32896	7263,94752
4,757	0,33589	36,27612	417,17538	4797,51687
8,165	0,20774	4,57028	50,27308	553,00388
$x^2 = 17,494$		356,96235	4590,69347	59283,83646

Bestimmung der Landesmediane erhalten worden ist. Auch dort sind abnehmende Prozentsätze bei dem 15. Lebensjahr bzw. bei dem 15,5 Lebensjahr zu finden (BOTYTYÁN etc., 1963).

Auf die Regression wurde mit 7 Freiheitsgraden eine Anpassungsprobe gemacht auf Grund dieser erwies sich unser Material als heterogen. Wenn die 15 Jährigen ausser Acht gelassen sind oder wenn die Probe bloss im Falle der 12—14 Jährigen (mit 3 Freiheitsgraden) gemacht wird, weist unser Material ebenfalls Heterogenität auf. Auch bei der Auswertung, die auf einem grösseren Material ebenfalls mit Probit-Methode durchgeführt wurde, erwies es sich als heterogen (BOTTYÁN etc., 1963). Dies kann mehrfache Ursachen haben. Eine davon liegt wegen der jahreszeitlicheen Schwankung im Zeitpunkt, wo die Angabensammlung stattfindet. Auch die eventuelle. Anwendung anderer Methoden (z. B. der LOGIT-Methode) kann in Frage kommen. Damit gingen aber die durch die einheitliche Auswertungsmethode gewonnenen Vorteile verloren. Wir sind der Meinung, dass die Diskussion dieser Frage über die Rahmen dieses Angabenberichtes hinausgeht.

Tabelle 3. Zusammenhang zwischen dem Menarche—Lebensalter der Mädchen aus Kecskemét und dem Monat des Auftretens der Menarche

Der Monat, wo die Blutung erschien	Das Lebensalter der Mädchen bei dem Auftreten der Menarche					Zusammen
	$-11\frac{1}{2}$	$11\frac{3}{4}-12\frac{1}{2}$	$12\frac{3}{4}-13\frac{1}{2}$	$13\frac{3}{4}-14\frac{1}{2}$	$14\frac{3}{4}-$	
Januar	5	17	8	1	—	31
Februar	6	5	5	—	—	16
März	6	13	6	1	—	26
April	3	8	2	1	—	14
Mai	6	6	7	—	—	19
Juni	2	15	8	2	—	27
Juli	6	9	10	3	—	28
August	9	5	13	1	—	28
September	4	9	8	2	1	24
Oktober	3	7	8	2	—	20
November	5	3	5	1	—	14
Dezember	6	5	6	2	—	19
Totalwert	61	102	86	16	1	266

In der 3. Tabelle haben wir unser Untersuchungsmaterial mit Rücksicht auf den Monat der ersten Blutung, sowie auf das Menarche-Alter der Mädchen bearbeitet. Dieser Tabelle ist folgendes zu entnehmen: während die Menarche Mediane $13{,}04 \pm 0{,}01$ Jahr ist, erfolgt die Blutung bei etwa 38% der Mädchen zwischen den Lebensjahren $11^3/_4$ und $12^1/_2$. In dieser Hinsicht zeigt sich eine grosse Ähnlichkeit mit den Angaben aus Szeged (FARKAS, 1962), die Mädchen aus Pécs weisen dagegen eine Abweichung auf. Bei den letzteren fällt das Maximum von 38% zwischen die Menarche-Lebensjahre $12^3/_4$ und $13^1/_2$.

Der Tabelle ist ferner zu entnehmen, dass die erste Blutung im höchsten Prozentsatz (11,6%) im Januar auftritt. Dieser Wert weist eine grosse Ähnlichkeit mit den analogen Angaben der Mädchen aus Szeged auf. Es zeigt sich eine ebenfalls grosse Häufigkeit in den Monaten Juni, Juli und August. Während aber die erste Blutung

Tabelle 4. Koinzidenz des Menarchemonates und des Geburtsmonates bei den Mädchen aus Kecskemét

Geburtsmonat		Menarchemonat												Zusammen	
		Frühling			Sommer			Herbst			Winter				
		III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	I.	II.		
Frühling															
	III.	3	4	3	1	3	5	1	2	2	4	3	1	32	
	IV.	3	1	—	2	2	1	—	1	1	1	3	2	17	73
	V.	3	1	1	2	2	2	2	4	2	1	3	1	24	
Sommer															
	VI.	2	2	—	2	1	1	2	3	—	1	1	1	16	
	VII.	2	1	1	2	2	2	1	3	—	—	2	1	17	49
	VIII.	1	1	1	2	1	1	3	—	1	1	2	2	16	
Herbst															
	IX.	1	—	1	2	4	3	5	4	2	5	3	—	30	
	X.	1	2	2	3	3	2	2	—	5	1	2	1	24	84
	XI.	3	—	5	2	3	5	3	1	—	3	4	1	30	
Winter															
	XII.	2	—	3	3	4	1	—	—	—	3	5	1	22	
	I.	3	3	4	1	4	3	4	1	1	1	2	3	30	76
	II.	3	1	—	3	1	3	2	1	3	—	4	3	24	
Totalwert		27	16	21	25	30	29	25	20	17	21	34	17	286	
		64			84			62			72				

bei 40,5% der Mädchen aus Szeged auf die Wintermonate (November, Dezember, Januar, Februar) fällt, ist diese Erscheinung nur bei 30,1% der Mädchen aus Kecskemét zur selben Jahreszeit zu beobachten. Dies ist schon deshalb interessant, weil

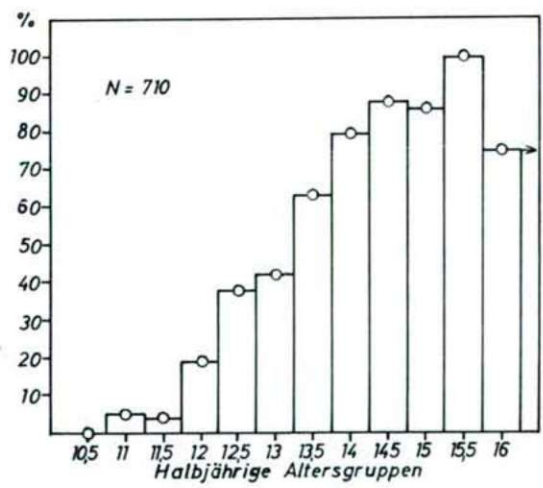

Abb. 1. Erfahrungsverteilung der Häufigkeit der menstruierenden Mädchen

auch VALŠIK darauf aufmerksam machte, dass die Menarche hauptsächlich in den „kalten" Monaten zu erfolgen scheint (VALŠIK, 1965).

Zuletzt haben wir die Angaben bezüglich der Koinzidenz des Geburtsmonates und des Menarchemonates in der 4. Tabelle zusammengestellt. Die Koinzidenz kam in 23 von 282 Fällen vor, was einer Häufigkeit von 8,1% entspricht. Da der theoretische Prozentsatz pro Monat 8,33% beträgt (ein Jahr = 100%) beweist die obenerwähnte Angabe, dass eine unterdurchschnittliche Häufung in den gleichen Monaten zu beobachten ist. In dieser Hinsicht weichen die Mädchen aus Kecskemét wieder von denen aus Szeged und Pécs ab. Bei den ersten fällt der Geburtsmonat mit dem Menarchemonat in 10,5%, bei den letzteren in 10,7% zusammen. VALŠIK erfuhr bei einer wesentlich zahlreicheren Stichprobe, dass der Zusammenfall der beiden Monate in 14,7% zu beobachten ist (VALŠIK—STUKOVSKÝ, 1963). Unsere Ergebnisse unterstützen also die Feststellungen von VALŠIK in dieser Hinsicht nicht, sie weichen sogar von ihnen wesentlich ab.

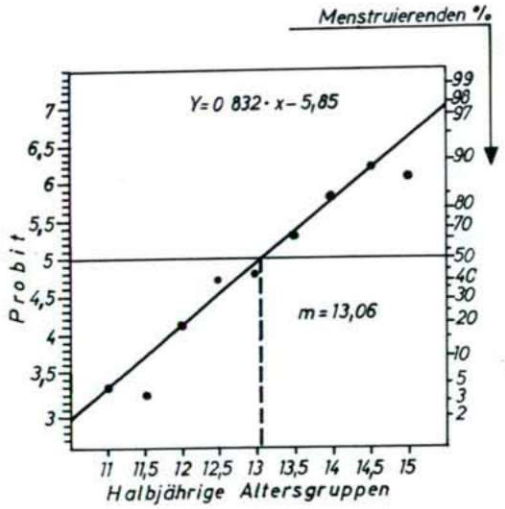

Abb. 2. Die Probit-Regressionsgerade des Zussammenhanges zwischen der Lebensjahr und der ersten Blutung auf Grund der Angaben von 710 Mädchen aus Kecskemét

Zusammenfassung

Es lässt sich feststellen, dass die Menarche-Mediane der Mädchen aus Kecskemét — 13,04 ± 0,01 Jahr — der ebenfalls durch PROBIT-Methode gewonnenen Landesmediane (13,23 ± 0,02 Jahr) sehr nahe kommt. Gleichzeitig weisen aber die Mädchen aus Kecskemét in Bezug auf das Menarche-Alter (= Lebensalter wo die erste Blutung auftritt), das Vorkommen der Menarche in den verschiedenen Monaten, weiterhin auf die Koinzidenz des Geburtsmonates und des Menarchemonates von den früher in anderen Ortschaften in Ungarn gesammelten Angaben gewisse Abweichungen auf. All dies beweist, dass unsere Stichprobe zur Bestimmung der Menarche-Mediane der Mädchen aus Kecskemét als geeignet bezeichnet werden kann. Die mit dem Auftreten der Menarche im Zusammenhang stehenden sonstigen Umstände lassen sich aber nur mit eingehenderen Untersuchungen aufklären.

Es scheint sehr wichtig zu sein, dass die Angabensammlung zur Untersuchung dieses Charakteristikums im Interesse der Vergleichbarkeit in den gleichen Monaten durchgeführt werde.

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Acta Biologica Szeged 16 (1—2), pp. 117—127 (1970)

A CRITICAL REVIEW OF PALEOANTHROPOLOGICAL STUDIES OF THE AVARS IN HUNGARY

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(Received June 25, 1969)

Introduction

The importance of populations and ethnic groups living in the Carpathian Basin in the Avar period (between 568 and 800—805) is extremely great as to the ethnic history of the Middle Ages. Owing to the relative scarcity of written sources, paleoanthropological and archeological findings are also of decisive importance. In a short critical survey I wish to give a list of anthropological studies dealing with the area of present time Hungary and attempt — with regard to the quantitatively and qualitatively varying merits of the respective articles — to give a brief critical and scientific evaluation, as well. Finally I have also the purpose of elucidating the history of researches and problems of the Avar age.

First of all it appears to be important to note that I do not think fortunate to undertake a merely mechanical enumeration where the author is completely impartial as to the merits of the paleoanthropological elaboration of a given series or to the importance of the interpretation in promoting science. In contrast to the old-fashioned craniometry one of the modern tendencies in historical anthropology is to study questions of the analysis and synthesis of paleoanthropology (not only of metric but also of comparative morphological character). This idea was exposed in details in several of my papers (LIPTÁK, 1961a, 1965).

While the enumeration given below tries to be complete, the annexed table does not contain all the sites, a few, less important ones having been omitted. The evaluative survey in the article attempts to give some basically important information from a uniform point of view; series having greater importance owing to the large number of measurements obtain a more plentiful description. The time of publication has been regarded as an important factor, since it means for later publications partly an increased number of comparative material, partly a wider differentiation of the point of view of the paleoanthropological studies. The following short survey makes it clear which are the merely informative papers and which raise — at least to some extent solve — new problems. Papers of general character dealing with the Avar age will be discussed later.

Review of series from the Avar period

From the early publications of the material I mention two monographs by L. BARTUCZ, one of them dealing with the Körösladány excavations concerned with a very fragmentary material of an extremely low number of cases (1929) and the other with the Mosonszentjános series without individual metric data (1929). I will later come back to that latter because of its taxonomic importance.

Afterwards was published a monograph of the same author concerning a limited number of skeletons around Jutas and Öskü (this time with individual metric data) in a volume, edited by GY. RHÉ and N. FETTICH, containing archeological studies (1920). L. BARTUCZ (again in a volume of N. FETTICH) in 1936 gave a brief description of the Avar age skeletal finds in county Fehér (Sukoró, Előszállás-Öreghegy, Előszállás-Bajcsihegy, Cece and Igar).

A rather brief account of six skeletons in the Kiszombor cemetery No. 0 was given by L. APOR and E. ROSZTÓCZY (1939). In this early Avar-age material artificial cranial deformation was also found.

Of the great number graves (889) from the Avar-age near Győr only 9 skulls were saved, a detailed description of them being given by J. NEMESKÉRI (1943). Unfortunately, relying upon the small number of material we cannot have a detailed picture of the population of this very important cemetery, but it is worth mentioning that is contains a certain Mongoloid component, as well.

The material of Ürbőpuszta (earlier Áporkai-Ürbőpuszta) with a much more considerable number of cases was elaborated b P. LIPTÁK (1951); it is predominantly of Europoid character. The excavations were done by T. HORVÁTH (1935); no simultaneous archeological evaluation had been done but this was later carried out (1957) by I. BÓNA.

The evaluation (by E. BÁTAI, 1952) of the skeletal remains of Váchartyán (excavation in 1950 by G. FEHÉR and co-workers) was not carried out with a faultless measuring technique, therefore it cannot be used for further comparaisons, but after a control of the metric data. An archeological description was given later (L. FERENCZY, 1963).

From the cemetery of Jánoshida (full name: Jánoshida—Tótkérpuszta) having a relatively great number of graves the excavators (led by FETTICH, 1933—34) did not endeavour to reach a complete saving of the skeletons. The anthropological material was worked up by WENGER (1953). As to its evaluation see LIPTÁK's remarks (1958).

The incomplete saving of anthropological material is even more characteristic of the cemetery named Szob-Homokok (excavations by HORVÁTH, 1928 and 1935), the material of which — together with series from the Árpádian age — was published by LIPTÁK (1953). No archeological evaluation has been done.

The first major series and its elaboration concern the Avar cemetery named Kecel I. (otherwise Kecel—Határdülő, excavations by FETTICH and HORVÁTH, 1932—33), where 54 skulls were saved from 91 graves, 45 of which proved to be suitable for detailed metric and taxonomic analysis. The series is distinguished by the possibility of establishing the hibridization of Europoids and Mongoloids very expressedly (LIPTÁK, 1954). These results were later used also by A. THOMA (1965) in his researches concerning fossil Man. In the same publication a very small material from Kecel II. (Kecel—Körtefahegy), completely Europoid in character, was also elaborated. Unfortunately no map of the cemetery is available. The archeological elaboration took place later (Á. Sós, 1958).

The taxonomic analysis relying upon a cemetery map of Üllő I. (Üllő—Disznójárás) was a considerable step forward both from theoretical and methodical points of view. Of 116 skeletons (excavations were done by FETTICH and HORVÁTH in 1931 and 1932) 82 were in excellent condition. This is the *only* greater Avar series published so far where the Mongoloid element can be pointed out to a marked extent. The archeological elaboration of the cemetery was carried out by T. HORVÁTH with the traditional method in 1935. In his methodically important work GY. LÁSZLÓ,

studying the Avar society with an archeological approach (1955), stated on the basis of cemetery map two clans (archeological groups), namely both the early and late Avars, as named by archeologists. The anthropological material supported the reality of separation beside establishing in one of the groups a very remarkable difference in the type-spectrum of males and females. The same anthropological publication contains the evaluation of the cemetery excavated by I. KOVRIG and Á. Sós in 1950 and 1951 and named by the author of the present paper Üllő II. A detailed archeological analysis of this was carried out and published simultaneously with the anthropological studies by Á. Sós in 1955. The enclosed Table contains Üllő III as well, containing two graves digged up later by KÁROLY KIS, an Üllő resident; this material was published together with the material of the cemetery Üllő I. Only for sake of completeness we mention that a few skeletons from the Üllő Avar age cemetery are housed in the Vienna Naturhistorisches Museum, as well.

An archeological evaluation of the Avar princely cemetery, excavated at the lane Kiskőrös—Vágóhid between 1935 and 1938, was done by GY. LÁSZLÓ in his work referred to above. He regards the cemetery as belonging to the early Avar period. A detailed elaboration of the material was performed by J. NEMESKÉRI (1955); the Mongoloid characteristics are strikingly dominating here. — The material of Mór—Akasztódomb was published, as well, by NEMESKÉRI in the same paper; unfortunately, the individual metric data do not contain any designation of males and females and no figures are given about this important material. The archeological elaboration was performed by GY. TÖRÖK (1955) who dates back the graves to the 6th century; thus it is easily possible that here we are having ancient Bulgarians.

In Csepel the skeletal remains of a distinguished Avar male of Mongoloid character have been digged up, their evaluation has been done by NEMESKÉRI in the same elaboration.

The first elaboration of the Szentes—Kaján material is connected with the namre of S. WENGER (1955); some critical remarks to his paper are given by L. BARTUCZ (1957). A complete evaluation of the cemetery becomes only possible if together with the map of the graves a new analysis could be done, possibly on the basis of the anthroposystematics followed in the course of the analysis of other graves from the Avar age. This material can be found in the Institute of Antropology of the Attila Jozsef University in Szeged, but the present stock is of lower number than published earlier. Anthropological studies have been carried out with 52 skulls of the Szentes—Kaján Avar age cemetery by S. WENGER (12 of them can be found in Budapest, 40 in Szeged). The Budapest material was not studied by Bartucz, but 31 crania (kept in Szeged) declared as fragmentary by Wenger were placed by him among the findings suitable for taxonomic determination. The series is of Europoid character. The archeological elaboration was done by J. Korek (1943), the publication does not contain the map of the graveyard.

As a result of excavations carried out in Zagyvarékas by N. FETTICH in 1930 7 skulls in a fairly good state were found which were studied by LIPTÁK (1956a). They were overwhelmingly Europoid with an expressed chamaecrany. This short article also contains the elaboration of sporadic finds of Mongoloid character, found at Dunaegyháza as well as that of the two skulls found near Vác in the course of the salvage excavation.

A total of 14 skeletons were found in the lane Kiskőrös—„Pobihuj" (excavations by HORVÁTH and FETTICH, 1933), of which altogether 10 adults were found suitable for detailed investigations (LIPTÁK, 1956b); the material is mostly Europoid and

partly of Mongoloid character respectively. No archeological evaluation has been done.

From 56 graves in Ondód, near Debrecen only 3 well preserved skulls could be saved (excavations of ZOLTAI and SŐREGI, 1925—26), they are distinguished with their pronounced Mongoloid character. Their taxonomic determination is partly erroneous (MALÁN, 1956). Archeological elaboration done by L. ZOLTAI and J. SŐREGI (1927).

Mention must also be made of shorter publications by WENGER, e. g. KONDOROS (1956a) with its 4 adult skulls and Kunszentmárton (1956b) with 3 rather incomplete adult skulls. Both finds are Europoid in character.

The second greatest Avar age series following Üllő I. is ,according to the order of publication, Homokmégy—Halom, excavated by FETTICH and LÁSZLÓ in 1936. From 167 graves 84 skeletons were saved, 71 adult ones in good condition. Metric and taxonomic study of them was done by LIPTÁK (1957). In the same journal the archeological evaluating remarks by GY. LÁSZLÓ (1957) were also published as an appendix to the anthropological study. This grave is mostly Europoid and of the anthropological components the Nordoid one is dominating, amounting to 47 per cent of the total population. The anthropological picture of the wealthy social layer and of the commons (servants) is different. Mediterranean race cannot be found among wealthy males while at the same time it is quite frequent among the common people and the not too numerous Mongoloid element is restricted merely to the group of the wealthy.

The anthropological study of the Avar age cemetery excavated near Alattyán village (this name is of Turkish origin) was first carried out by S. WENGER, who had published his preliminary results — not free of errors) — in 1952, then correcting the sexes he again published the whole material in details, with individual metric data (1957). Up to the present time this is the greatest anthropological series from the Avar age. Altogether 225 adult (117 male and 108 female) crania could be subjected to more detailed investigations. The Alattyán cemetery is one of the most completely excavated graveyards dating back to the Avar age. The process of work was fairly long indeed (1934—1938), with participation of several archeologists (N. FETTICH, GY. LÁSZLÓ, I. MÉRI and GY. DOMANOVSZKY). Its archeological finds were elaborated in a special volume of monographs by I. KOVRIG (1963). In a chapter of this monograph I carried out the comparative paleoanthropological evaluation of the skeletal remains of the cemetery, including an analysis on the basis of the map of the graveyard, too. In the anthropological material of the graves the most important component is the brachycranial group, Cromagnoids and Mediterraneans being close next.

The material from Tiszaderzs was elaborated by LEBZELTER. His manuscript remained unpublished for quite a long time in Hungary, at last in a somewhat shortened from it appeared in „Crania Hungarica" (1957). He studied the skeletal remains of altogether 33 adults. Relying upon LEBZELTER's work and also having studied the skulls themselves, I have carried out the taxonomical analysis again, with the result that in this series the Nordoid race is dominating.

Near Újkécske—Óbög salvage excavations were carried out by FETTICH in 1931: only 10 graves were found of which two males of Mongoloid type were suitable for metric examination (LIPTÁK, 1958).

Much more important is Tiszavárkony, where on the border of the Tisza inundation plain salvage excavation were performed by Á. Sós and P. LIPTÁK in 1952.

A cemetery mostly from the early Avar period (7th century) was foud here with horse graves and iron swords. Only a long and narrow stretch of the cemetery could be excavated and the unequal distribution of the sexes could likely be ascribed to this fact. Namely of the 52 skeletons from 92 graves, 23 males and 9 females were in good condition. This cemetery from the early Avar period is almost completely of Europoid character. The probability of Avars being involved is largely supported by the name Várkony (varchonites!). Unfortunately enough, the archeological evaluation has not been done, as yet; publication of the anthropological material was done by LIPTÁK (1958).

At the lane Szigetszentmiklós—Háros salvage excavations were carried out by Á. Sós and P. LIPTÁK in 1954. From 23 graves 11 skeletal remains were unearthed in a rather bad condition, only 4 of them being liable to a more detailed anthropological examination. First the anthropological study was done (LIPTÁK, 1958), while the archeological description was performed by Á. Sós (1961). The cemetery can be dated to the first half of the 7th century, it had been rather rich but later sacked. Part of the skulls is Armenoid in character what indicates the eastern origin of the population.

A reliable differential diagnosis based upon the skulls of Europoids and Mongoloids is quite an old problem and in this respect there is a fairly wide uncertainity in the literature of anthropology. The solution of this question was made possible through a thoroughful taxonomical analysis of the Mongoloid anthropological components of Avars in Hungary. But is was a long way till collecting the material for investigation.

To this end from the anyhow predominantly Mongoloid series and from the scattered finds a comprehensive series was gathered. This contained on the one hand some material already published as e. g. Mosonszentjános — where the measures were to be taken again since the original publication had not contained them —, Öskü (evaluation by BARTUCZ), Győr, lane Kiskőrös—Vágóhid and Csepel (elaborated by Nemeskéri), Debrecen—Ondód (elaborated by MALÁN), the Üllő I., Kiskőrös—„Pohibuj", Újkécske—Óbög (elaborated by Lipták) as well as the Mongoloid skulls from Váchartyán (remeasured by me) and, as a new material, remnants from Harka, Kiskőrös—Cebepuszta, Öcsöd, Tatárszentgyörgy and Madaras. Of all these altogether 87 skulls (81 in very good state of preservation) of Mongoloid character were examined (LIPTÁK, 1959). Finally this combined series also incorporated the material from the small Avar cemetery near Budapest-Népstadion, where from 35 graves 17 skeletons were unearthed, of them 7 were adults in good condition with pronounced Mongoloid characteristics. A detailed study of the Népstadion cemetery was published later (LIPTÁK, 1963). My work about the Mongoloids of the Avar period in Hungary gave a chiefly morphologic differenctial diagnosis of the Europoid and mongoloid great races. Craniosystematics developed within the Mongoloid great race differs from that given by authors in West and Central Europe incorporating successfully the results of the Soviet anthropologists. Owing to this it became clear that the „Mosonszentjános-A" type, so well described by BARTUCZ, is the same as the Baikal race described by Soviet authors.

A detailed description of the Avar age cemetery at Szebény is given by T. TÓTH (1961). He carried out the paleodemographic and also the horizontal facial profiling examinations — introduced just by him into the Hungarian anthropological literature — besides the traditional Martin method. From the 341 graves only 38 adults in good condition were suitable for anthropological examinations. The material

is completely Europoid in character thus the author regards is not as Avar but only an Avar-age cemetery.

The Csákberény cemetery from the 6th—7th centuries was excavated between 1936 and 1939 (by A. MAROSI and GY. LÁSZLÓ with their co-workers), the elaboration of the skeletal remains was done by T. TÓTH (1962). His method was the same as in the former publication. The skeletal material in this cemetery of 452 graves might have been in a very bad condition as only 21 adult skeletons in good condition could be subjected to anthropological examination. The anthropological picture of the graveyard is similar to that of the Szebény cemetery, however, slight Mongoloid element can be traced. As to the ethnic character several alternatives are suggested by the author.

The excavations of the Avar age cemetery at Szeged—Kundomb were carried out in several phases (1926—1929 by F. MÓRA and K. SEBESTYÉN, 1939 by K. SEBESTYÉN and 1944 by D. CSALLÁNY). From 319 graves 176 skeletons were saved, of them 133 adults in good condition (62 males and 71 females) were suitable for a detailed morphotaxonomic study (LIPTÁK—MARCSIK, 1966). In this great series the ratio of brachycranes is overwhelming, followed by Cromagnoids and Nordoids. The presence of a chamaecrane group with archeomorphic character is striking, sometimes connected also with Mongoloid characteristics. As to the anthropological factors the Szeged—Kundomb population is closest to the Avar age population of Alattyán. Europoids are in great majority also here.

A series compiled from the sporadic finds of Avars in the precincts of Budapest was published by OLGA BOTTYÁN (1966). They are from the following sites: Békásmegyer, Óbuda—Szöllő street, Törökbálint road, Rákospalota, Soroksári road, Rákoshegy, Rákos parachute training tower, Rákoskeresztur. Altogether 13 skulls of them (6 males and 7 females) were suitable for metric examination. The material is quite heterogeneous. The males are of Europoid and Europo-Mongoloid, the females of Mongoloid character.

Excavations of the material of the late-Avar cemetery at Ártánd were begun already in 1931 by J. SŐREGI, however, a systematic uncovering was performed only between the years 1955 and 1957 by KINGA ÉRY and A. KRALOVÁNSZKY. They have opened up the cemetery nearly completely, unfortunately about sixty per cent of the graves were destroyed as a consequence of sand mining. From 262 graves 258 skeletons were saved, they may, however, haveb een in very poor state of preservation as only 36 males (only 18 in really) and 27 females (16 in fairly good state of preservation) proved to be suitable for a detailed investigation. The anthropological material was published in two articles by KINGA ÉRY (1966 and 1967, respectively). The previous paper publishes extensive metric data as to the whole on the skeletal remains and attempts to express quantitatively a number of morphologic characteristics. The more comprehensive second publication besides traditional evaluation contains detailed paleodemographic data, as well. The author deals with the series as a whole, Penrose's method of „distance analysis" is applied to compare it with series found in the area of the Soviet Union. More detailed taxonomic analysis is not included. The material is completely Europoid in character.

Salvage excavations were carried out in „Bajcsi-hegy" near Elöszállás already in 1930 (led by L. APOR). A brief publication of the saved scanty anthropological material was given by BARTUCZ (1936). The salvage excavations continued in 1952, but hundreds of graves were found already destroyed. From 251 graves 229 skeletons were uncovered in poor preservation, of them 49 males (only 15 in really good state)

and the same number of females (9 in a good state of preservation) were suitable for metric examinations. A too detailed description of the material was given by S. WENGER (1966) on more than 80 pages, where he gives the description of all the skeletons and crania together with metric data, but there are several skulls with only a few measurements (about 3—8) and characteristics. He deals with this cemetery in a more compact manner in another article published in Hungarian (1967) where he carries out first of all a detailed comparison without publishing parameters. In reference to the material instead of taxonomic determination only combinations of characteristics are mostly given by the author. This small series is mostly of Europoid character.

As a result of excavations in lane Kisrét near Vác led by GY. DEZSŐ and A. KRALOVÁNSZKY in 1958—59, 82 graves of a large cemetery from the late Avar period (supposedly containing 400—500 graves) were unearthed. Three skeletons came probably from the same cemetery as a result of salvage excavations by Á. Sós in 1952, of which 2 skulls in a good state of preservation were described in a publication mentioned previously (LIPTÁK, 1956a). The anthropological elaboration of skeletons digged up recently was done by GY. GYENIS (1968). Of the saved 70 skeletons 20 males (only 9 in really good state) and 19 females (11 in a state of good preservation) were suitable for elaboration. The author gives description of the whole material, for characters with greater number of cases the parameters as well as tables of characteristics of crania based upon the more important indices and finally also measurements of long bones. Individual measurements are also included. The material is Europoid in its character.

In August 1950, salvage excavations were done by GY. LÁSZLÓ, B. SZŐKE, D. CSALLÁNY and P. LIPTÁK in the neighbourhood of the village Bágyog on a hill called Gyürhegy. In this hill sand has already been mined for a longer time. Because of the endangerment of the area the sand mine was surrounded by sections of excavation to prevent — at least for a time — the destruction of the graves. The examination of the anthropological material was started by MÁRTA DEÁK, formerly working in the Museum of Győr, later the task was carried on by M. MALÁN within the frames of the museum registration. Finally GY. DEZSŐ was trusted with this work. The very careful salvage work resulted in 83 skeletons (because of double graves!) of which, according to the data of GY. DEZSŐ, the crania of 23 adult males and 20 females in a good state of preservation were subjected to metric examination. The published parameters refer to a somewhat lower number of cases. Unfortunately the author did not publish individual measurements, this circumstance is to be stressed because the skeletal remains of the cemetery are rather heterogeneous, they equally contain races belonging to the Europoid and Mongoloid great races. Archeological finds have not been published.

Near Fehértó northwest of Szeged, between the years 1929—1932 a cemetery from the Avar age was digged up in four phases under the supervision of the Szeged Museum, directed by F. MÓRA with co-operation of K. SEBESTYÉN. Archeological elaboration has not been done, so far. From the total of 376 digged up graves the remains of 204 skeletons are now housed in the Institute of Anthropology of the Attila József University, Szeged. Of the 151 adult skulls in a good state of preservation 75 males and 76 females were suitable for a more detailed metric and morphotaxonomic study (LIPTÁK—VÁMOS 1969). Thus following the Alattyán findings this is the second greatest series from the Avar age. Long bones were saved only in the case of 51 individuals. In the material the brachycrane group is the most important

„Avar period" (6th—9th century) series analysed anthropologically

Number	Site	Excavated		Well-preserved adults			Author, date of publication
		graves	skeletons	males	females	total	
1	Jutas	244	23	8	15	23	Bartucz, 1931
2	Öskü	77	15	88	7	15	Bartucz, 1931
3	Győr	889	9	5	3	8	Nemeskéri, 1943
4	Ürbőpuszta	56	39	10	13	23	Lipták, 1951
5	Váchartyán	64	35	10	14	24	Bátai, 1952
6	Jánoshida	256	46	21	12	33	Wenger, 1953
7	Szob—Homokok	113	10	4	3	7	Lipták, 1953
8	Kecel I	91	54	26	19	45	Lipták, 1954
9	Kecel II	15	9	4	4	8	Lipták, 1954
10	Üllő I	259	116	41	41	82	Lipták, 1955
11	Üllő II	153	115	30	27	57	Lipták, 1955
12	Üllő III	2	2	1	1	2	Lipták, 1955
13	Kiskőrös—Vágóhíd	75	11	6	4	10	Nemeskéri, 1955
14	Mór	25	11	7	2	9	Nemeskéri, 1955
15	Csepel	1	1	1	—	1	Nemeskéri, 1955
16	Szentes—Kaján	459	115	34	18	52	Wenger, 1955 Bartucz, 1957
17	Zagyvarékas	9	8	2	5	7	Lipták, 1956a
18	Kiskőrös—„Pohibuj"	28	14	7	3	10	Lipták, 1956b
19	Debrecen—Ondód	57	5	2	1	3	Malán, 1956
20	Kondoros	7	4	2	2	4	Wenger, 1956a
21	Kunszentmárton	10	4	1	2	3	Wenger, 1956b
22	Homokmégy—Halom	167	84	37	34	71	Lipták, 1957
23	Alattyán	708	244	117	108	225	Wenger, 1952 and 1957 Lipták, 1963
24	Tiszaderzs	102	34	16	17	33	Lebzelter, 1957
25	Tiszavárkony	92	58	23	9	32	Lipták, 1958
26	Szigetszentmiklós—Háros	23	11	2	2	4	Lipták, 1958
27	Harka	1	1	1	—	1	Lipták, 1959
28	Kiskőrös—Cebepuszta	5	4	—	4	4	Lipták, 1959
29	Öcsöd	1	1	—	1	1	Lipták, 1959
30	Tatárszentgyörgy	54	14	2	3	5	Lipták, 1959
31	Madaras	5	5	2	—	2	Lipták, 1959
32	Mosonszentjános	276	105	(22) 8	(38) 8	(60) 16	Bartucz, 1929 Lipták, 1959
33	Szebény	341	140	29	9	38	Tóth, 1961
34	Csákberény	452	102	14	7	21	Tóth, 1962
35	Budapest—Népstadion	35	17	6	1	7	Lipták, 1963
36	Szeged—Kundomb	319	176	62	71	133	Lipták—Marcsik, 1966
37	Budapest környéki avarok	21	21	6	7	13	Bottyán, 1966
38	Artánd	262	258	(36) 18	(27) 16	(63) 34	K. Éry, 1966 (1967)
39	Előszállás—Bajcsihegy	251	229	(49) 15	(49) 9	(98) 24	Wenger, 1966 (1967)
40	Vác	82	70	(20) 9	(19) 11	(39) 20	Gyenis, 1968
41	Bágyog—Gyürhegy	80	83	(23) 20	(20) 17	(43) 37	Dezső, 1968
42	Fehértó—A	376	204	75	76	151	Lipták—Vámos, 1969

in number, but it only represents 25 per cent of the population. Next come Mediterraneans with a total of about 20 per cent, with a small percentage of Iranian (East Mediterranean) element within. In the Cromagnoid group the Cromagnoid-A taxon is the more important one. The Mongoloid component could almost be neglected. The total of the studied population indicates a common-people stratum with anthropological composition largely supporting the continuity of the population of the Avar age and that of the Árpádian one. The remarkable number of cases permits such a deduction.

General remarks

From the publications of general character we mention first the concise monograph of L. BARTUCZ (1934) quoted frequently. Concerning some single characteristics BRATUCZ carried out comparative studies, as e. g. in reference to the stature of Avars (1946—1947). He has the merit to be a pioneer of paleodemographic researches — this time concerning the Avars (1950). Taxonomic characterization of the anthropological aspect in the Avar-age populations was given by me two times (LIPTÁK, 1961, 1963). T. TÒTH published (1967) the means of supplementary data of the horizontal faciel profile in reference to series already having been elaborated by other authors, unfortunately without publishing individual measurements.

In the present review I do not consider important to deal much with the paper of E. KRECSMÁRIK (1927) referring to the Avar-period cemetery near Nagykamarás. I have similarly made no mention of the paper of J. GÁSPÁR (1928) concerning four adult crania in good state of preservation from Sobor (county Komárom) regarded by him as belonging to the age of the Hungarian conquest. This scanty material, however, originates in reality from the Avar period (CSALLÁNY, 1956).

Mention must, however, be made of some major Avar or Avar-age cemeteries the material of which is already elaborated but for the time being in manuscripts (or in press). They are the following: Lane Kiskőrös-„Város alatt" (49 males, 51 females), Szekszárd-Palánk (27 males, 37 females) and some smaller but in one respect or another still important materials as e. g. Bakonykoppány, Csengele-Feketehalom, Rákóczifalva-Kastélydomb, Szarvas-Kákapuszta-Kettőshalom (this latter coming from the 9th-10th centuries).

Short summary

It can be laid down as a fact that concerning the anthropology of the Avars in Hungary there have been published also very considerable works promoting the problem of Avar ethnogenesis. It could be verified that a profound knowledge of the Avar-age populations is indispensable for the ethnogenesis of the Hungarian population. An athropological synthesis of the Avar age from this point of view was carried out by P. LIPTÁK (in his monography in DSc: „Paleoanthropology of Ethnogenesis of the Hungarian People", being a dissertation submitteld in Summer 1967 for the degree: „Doctor of Biological Sciences"). This contains also a comparative elaboration of the series listed above — but so far not published.

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Acta Biologica Szeged 16 (1—2), pp. 129—138 (1970)

TRIAS–KORALLEN AUS JUGOSLAVIEN II

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(Eingegangen am 9. Oktober 1968)

Von Herrn Geologie-Ingenieur IVO STRUCL erhielt ich im Jahre 1968 aus Mezica mehrere Trias-Korallen-Urreste zur Aufarbeitung zugesandt. In dem Begleitschreiben hiess es unter anderem: „Es handelt sich um ein neues Riff, dessen Alter noch unbekannt ist (Ladin oder Karnische Stufe)".

Meinen Beschreibungen füge ich auch jetzt Originalzeichnungen bei, die ich von in Stein eingebetteten winzigen, ausgeätzten Funden herstellte. Wegen ihrer Kleinheit und ihres schlechten Zustandes waren sie — von wenigen Ausnahmen abgesehen — weder zum Photographieren noch zum Schleifen geeignet.

Ich hatte bereits 1967 über Trias-Korallen aus Jugoslavien berichtet, und sowohl jene, als auch die jetzigen Arten stimmen — von geringfügigen Abweichungen abgesehen — mit den Mitgliedern der Trias-Korallenfauna ähnlichen Alters aus den Alpen (Österreich), Karpaten (CSSR), Pannonien und Nord-Ungarn überein. An sämtlichen erwähnten Fundorten kommen neben Riff-Facies auch Peririff-Gebilde vor, sehr häufig in Gesellschaft von Schwämmen und Hydrozoen, sowie Lammellibranchiaten-Überresten.

Dem 85-Jährigen Triglaw-Schwärmer, Herrn Zoologen DR. ANTON GEBHARDT — gleichsam aus Anlass des 35. Jahrestages unserer Freundschaft — gewidmet vom Versasser.

Das neue Material ist folgendes:

I. Rudnik—Mezica; Peca 2000 m. Weisslich-grauer Kalkstein.

Thecosmilia badiotica VOLZ; etwas zerdrücktes Korallen-Siedlungsbruchstück mit 6—8 mm Polypen-Durchmesser und typisch auf diese Art hindeutendem Septensystem. Seine Anwesenheit deutet auf die ladinische Stufe hin.

Craspedophyllia alpina LORETZ; angesichts ihrer auserst grossen Kolumelle leicht erkennbare Art; Polypenquerschnitt: 13×14 mm. Kolumellendurchmesser: 1,5 mm. Gesamt-Septenzahl: 120. System und Gestaltung der Septen, sowie die Entwicklung des dichten endothekalen Systems entsprechen ebenfalls den Genus-Merkmalen. Die Art gehört dem Ladin an, ist höchst variabel und polymorph (s. Abb. 1).

II. Vzorec, hellgrauer Kalkstein

Craspedophyllia alpina LORETZ. Vorstossender Kelchraum 8×12 mm. Höhe des eingebetteten Polypen 17 mm, zur Basis hin allmählich verschmälert. Vordringen der Basis in der Gesteinstückhälfte 6×4 mm. Kolumellen—Durchmesser:

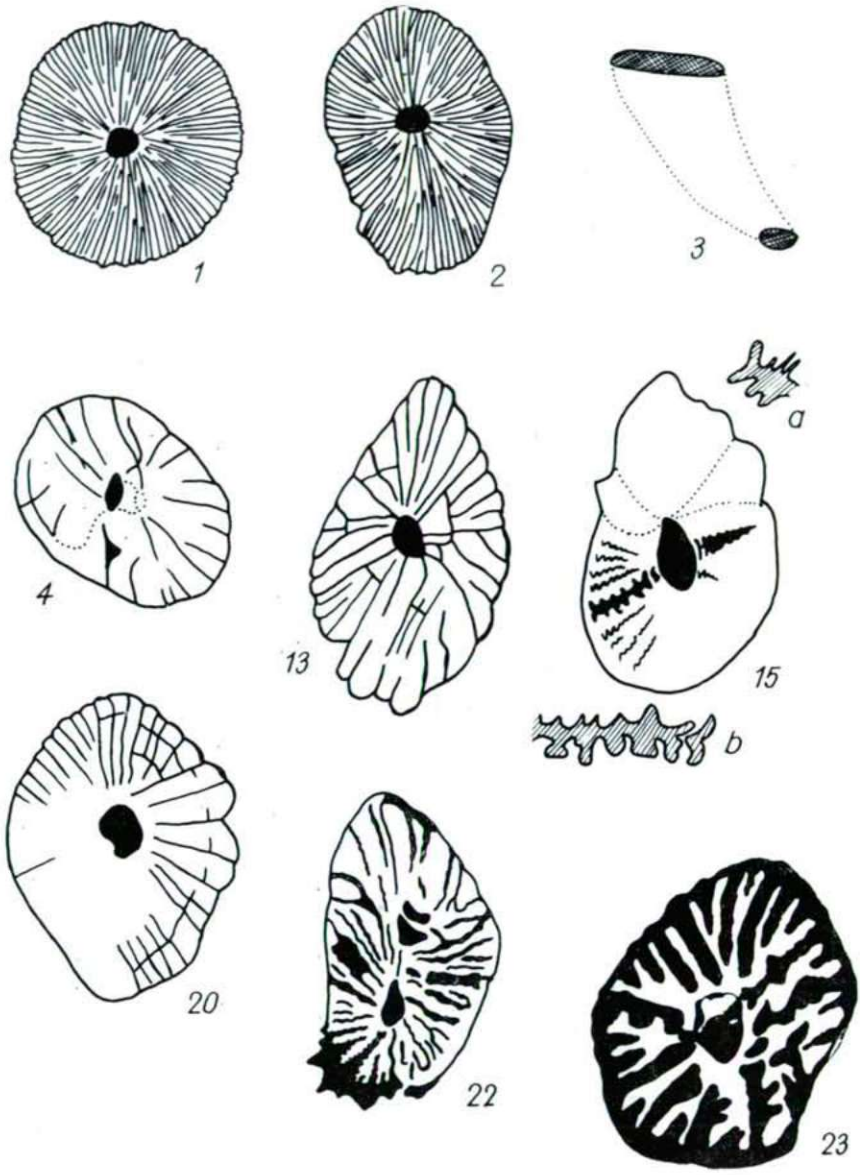

Abb. 1. *Craspedophyllia alpina Loretz:*

1 Kelch 13×14 mm; Kolumelle 1,5 mm
2 Kelch 8×13 mm; Kolumelle 1×0,5 mm
3 Polypenlänge 17 mm
4 Basis 6×4 mm
13 Kelch 7×13 mm
15 Kelch 2×3 mm; Kolumelle 1×0,5 mm
20 Kelch 3×4 mm; Kolumelle 1,5×1,8 mm
22 Querschnitt des knospenden Polypen 3×5 mm
23 Kelch 3×5 mm; Kolumelle 1,8 mm

1×0,5 mm. Am Kelchsaum kommen auf 1 mm 3 Septenbasen. Die Zahl der nicht zählbaren Septen beträgt mehr als 100. In der Basis können die II.- und III.-rangigen Septen auch konfluierend sein. (s. Abb. 2—4).

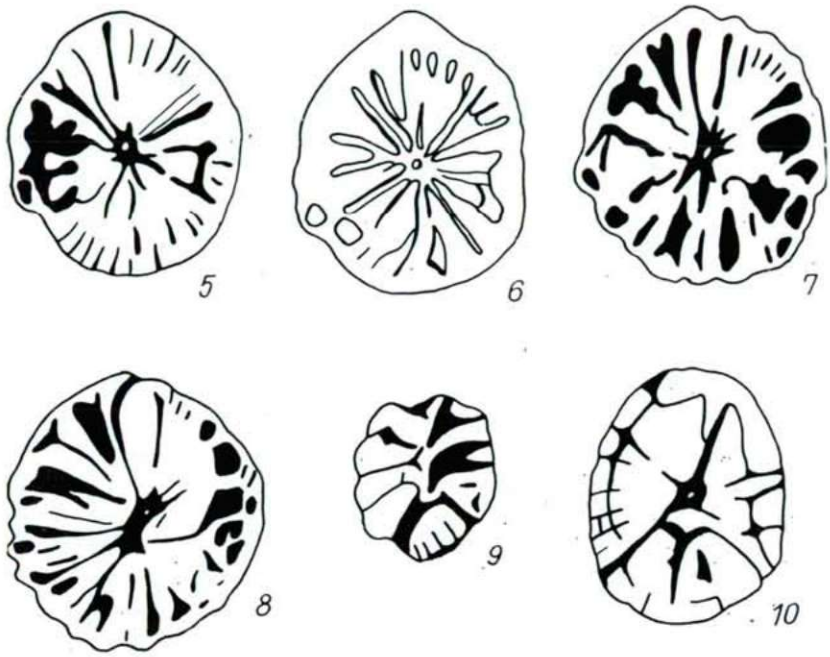

Abb. 2. *Oppelismilia karawankana* n. sp.

6—8	Kelch 5×6 mm
9	Basis 2,5×3 mm
10	Basis 2×2,5 mm

III. Vzorec, stark heller Kalkstein

Thecosmilia badiotica VOLZ.; kleines Siedlungs-bruchstück; die Polypenrohre sehr lockerstehend: erodiert, Durchmesser 5—8 mm. Manche in Teilung begriffene Röhrchen nur je 5 mm, aber in 15 mm Abstand. Dies ist eher ein *Thecosmilia subdichotoma*-Merkmal (ebenfalls charakteristisch fürs Ladin). Am Polypenrand kommen auf 1 mm 4 Septenbasen.

IV. Nördliche Karawanken; 2500 m süd-ösllich von Zerjan im Hlev-Graben, gräulich-bräunlicher Kalkstein: Ein üppiges Urrest-Gesteinstück, ein Agglomerat aus Schwämmen. Hydrozoen und Korallpolypen. Hie und da glaubte ich auch Gastropoden-Bruchteile von *Littorina*-Grösse zu entdecken. Meines Erachtens eine Peririff-Facies.

Genus: *Oppelismilia*

Einzel- oder Kolonienkorallen. Septen dick, uneben, mit variierendem Cyklus; Kolumelle knopf- oder papillenförmig im Querschnitt, oder es sind *Semipalus* zugegen. Ind der mittleren Trias seltener — in der oberen Trias lebten einige stratigraphisch wichtige Arten *(Oppelismilia zitteli)*. — In dem gegenwärtigen Material fand ich zwei neue Arten, nachstehend ihre Beschreibung:

Oppelismilia karawankana n. sp.

Kleiner, unebenmässiger Polyp; dicke, unebenmässige Septen; die winzige, knopfartige Kolumelle sondert sich ausgesprochen von den Septenenden ab. Kelchdurchmesser fünf- oder sechseckig oval-rund. Aussenrippen ungleichmässig-, Epithek grösstenteils abradiert, Septenzyklus ca. 3. Das endothekale System im Kelch schütter, der peripherische Ring wahrscheinlich kontinuös. An einigen Stellen ziehen die III.-rangigen Septen in die benachbarten Septen. Die 6 Protosepten sind von den übrigen hinsichtlich ihrer Entwicklung zu unterscheiden. Daneben beträgt die Zahl der grossen Septen ebenfalls 6 oder 7. d. h. die Zahl der II.-rangigen im Verhältnis zu den 6 Prosepten. Die Septen I. und II. Ordnung sind mehr oder weniger gleich entwickelt, während jene III., Ordnung kürzer, sonst aber ebenfalls ziemlich dick sind (s. Abb. 5—8).

Einige Querschnitte von 2,5×3, bzw. 2×2,5 mm mit gut isolierten Protosepten und Endothekalring (Basaltalon-Endothek stammen ebenfalls von dieser Art (s. Abb. 9 und 10).

Oppelismilia gebhardti n. sp.

Polypenrohr-Durchmesser in dem erodierten Gestein: 1,5×2, 2,8×3 und 2,5×3 mm. Drei Exemplare. Kelchraum sechseckig oder sphärisch rund. Septenzahl 20—50, genau nicht zählbar. Kolumelle papillös oder semipalusartig. Septen dick, Cyklus ca. 3-. Die Dicke der Septen ist ungefähr gleich, ihre Länge aber unterschiedlich entwickelt. Dieser Fund, bzw. diese Funde dürften identisch sein mit der aus der mittleren Trias beschriebenen, aber als Art nicht benannten *Oppelismilia* sp. — Das Septensystem zeigt bisweilen bilaterale Tendenz. Diese drei Typen angehörenden Exemplare habe ich an den Abbildungen 14, 16, und 18 dargestellt.

Epoche	Arten	Durchmesser mm	Höhe	Polyp	Epithek	Septenzahl	Kolumne	Zyklen	Fundort
Obere	*zitteli*	15—20	10—15	konisch	Basal-Talon	24—29	gross	3	Alpen
Trias	*dedinkyensis*	5—6	?	zylindrisch	Basal-Talon	34	klein	3	CCSR
Mittlere	*karawan-kana*	5—6	?	zylindrisch konisch	Calyc-Indig.	24—32	klein	3	Jugoslavien
Trias	*gebhardti*	1,5—5	?	?	Calyc-Indig.	20—32	papillös	3—5	Jugoslavien

Es müssen auch mehrere, etwas abweichende Polypchen hierher gezählt werden; ihr Durchmesser beträgt 4—5 mm, und der Septenzyklus ca. 5. Die Wand ist mehrminder dick. Ihre Form geht aus den Zeichungen 24, 25 und 26 hervor.

Zum Vergleich diene hier eine Tabelle, welche die Daten der beiden aus der oberen Trias stammenden und unserer neuen Arten enthält.

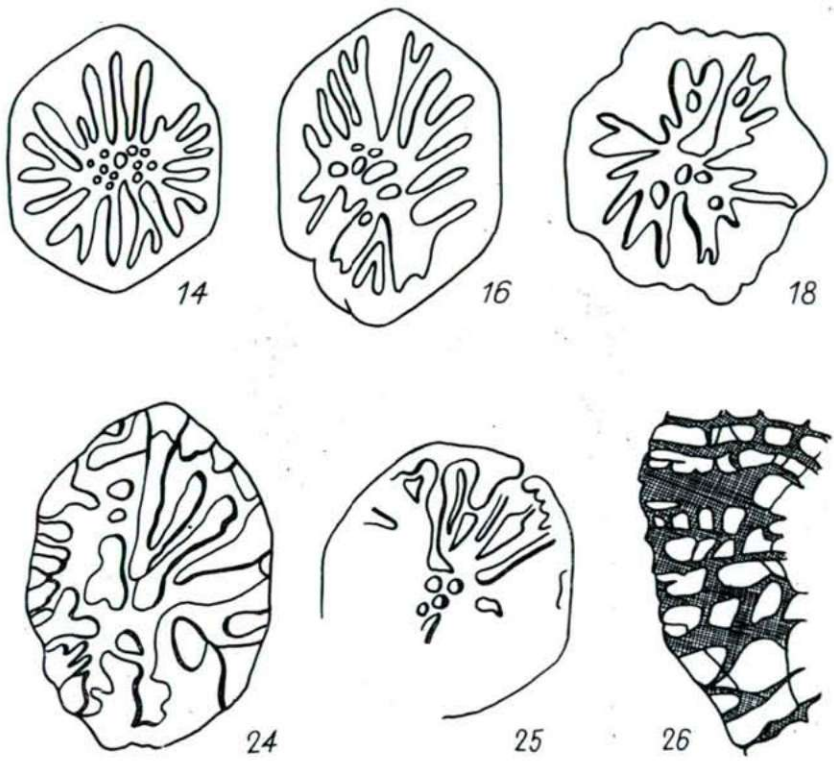

Abb. 3. *Oppelismilia gebhardti* n. sp.

14	Kelch 1,5×2 mm
16	Kelch 2,8×3 mm
18	Kelch 2,5×3 mm
24	Kelch 3,8×4,8 mm
25	Kelch 4×4 mm
26	Septensystem mit starker Vergrösserung

Genus: *Conophyllia*

Einzeln, in Gruppen oder Kolonien lebende Korallen, mit triadem, d. h. palaeozoischen, bzw. semibilateralem, oder semiradialem Septensystem. Endothek dicht, mit starker Konfluenz der Septen. Kolumelle konsequent klein, knopfförmig, umgrenzt. In der Erosion treten die Polypenköpfe konvex aus der Gesteinsoberfläche hervor! Der Genus ist bereits im Anisikum aufgetreten und hat eine Differenzierung durchgemacht.

Conophyllia radiciformis (KLIPSTEIN) VOLZ.

In unseren Gesteinsproben der häufigste Polyp. — Durchmesser bei juvenilen und adulten Polypen zwischen 2—7 mm. Die Polypen finden sich gewöhnlich nahe beieinander vergesellschaftet. Kolumelle klein, knopfförmig. Zahl der Septen — infolge der sekundären Veränderungen — nicht immer feststellbar, in der Regel aber zwischen 50 und 70 variierend. Die Protosepten sind mitunter gut differenziert und zerlegen den Kelchraum in 6 Sektoren. Der Triaden-Typ ist übrigens bei allen Exemplaren sehr gut zu beobachten. Endothek dicht. Querschnittskontur der Polypen im grossen und ganzen stets pentagonal. Septenzyklen gewöhnlich 3, aber eventuell auch mehr. Über die gefundenen Exemplare informieren die Abbildungen 11, 12, 19, 20, 28 und 29. Einige Funde konnten infolge Erosion auch in ihrer Länge erschlossen werden, so dass auch die ursprüngliche Länge der Polypen feststellbar wurde; sie betrug 10 mm und der Kelch in diesen Fällen 5×5 mm, d. h. die Polypen zeigen

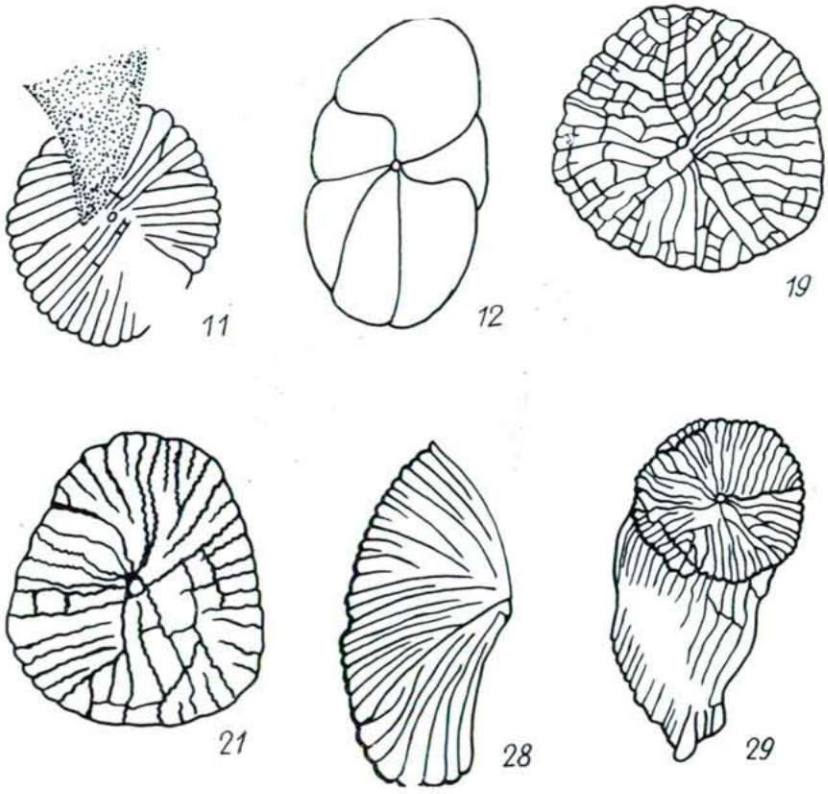

Abb. 4. *Conophyllia radiciformis* (Klipstein) Volz.

11	Kelch 6×7 mm
12	Kelch 2,5×4 mm
19	Kelch 2,5×3 mm
21	Kelch 2,5×3 mm
28	Kelch 6×7 mm
29	Kelch 5×5 mm, Polypenlänge 10 mm

eine zur Basis hin verschmälerte Form, können also deshalb auch als semizylindrisch bezeichnet werden. Die Polypenlängsachse ist etwas gebogen, so dass der kürzere ventrale Teil sich vom konvexeren dorsalen abhebt. Die Art war in der ladinischen Stufe ziemlich verbreitet.

Conophyllia recondita (LAUBE) VOLZ.

Diese Art hat kleinere Polypen als die soeben beschriebene. Ihre Grösse variiert zwischen 2 und 5 mm. Ebenfalls vergesellschaftet lebend; auch die Kolumelle ist konsequent von kleiner Knopfform. Septenzahl geringer als bei der vorigen Art, sie variiert zwischen 26 und 42. Das Septensystem ist auch hier urtypisch triad und die sechs Protosepten kommen bisweilen sehr deutlich zur Geltung. Endothek ebenfalls dicht, Polypendurchmesser aber nicht pentagonal, sondern ausgesprochen rund. Septenzyklus 3 oder auch mehr. — Die Siedlungsform nimmt auch an der Riffbildung teil (Alpen und das nordungarische Bükk-Gebirge. — Polypenlänge um 4 mm, eher zylindrisch als trichterförmig (die Zeichnungen finden sich an Abb. 17 und 27.)

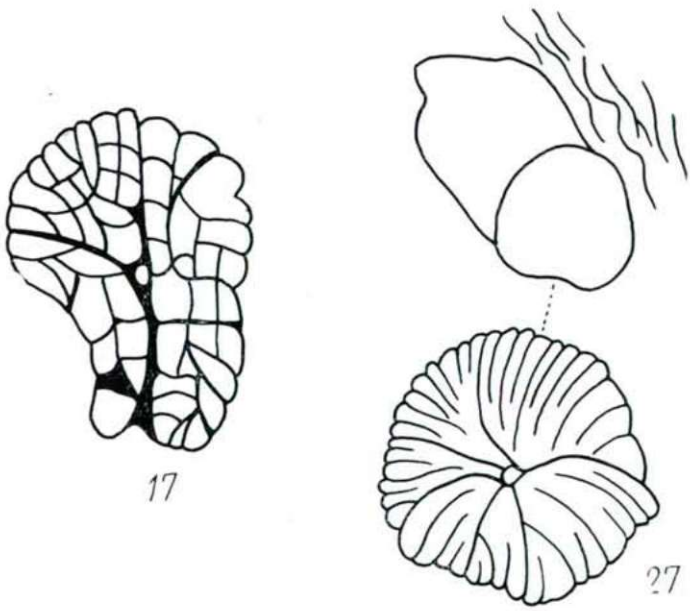

Abb. 5, *Conophyllia recondita* (Laube) Volz.

17 Kelch 3×5 mm
27 Kelch 2×2 mm, Polypenlänge 4 mm
Orig. del. autor.

Arten	Durchmesser mm	Polypen	Länge mm	Kolumelle	Septenzahl	Septenord.	Endothek	Kontur	Zyklen
C. radici-formis	2—7	vergesellschaftet	10	klein, knopfförmig	50—70	triad	dicht	pentagonal	3?
C. recondita	2—5	vergesellschaftet	4	klein, knopfförmig	26—42	triad	dicht	rund	3?

Genus: *Craspedophyllia*

Alleinstehende, höchstens in Gruppen vorkommende Korallen. Ihr Septensystem ist entwickelter als der Conophyllien. Es gibt weniger triadische Konfluenzen und auch die Septen sind differenzierter, oft stachelig. Endothek sehr dicht. Die sekundäre, stereoplasmatische Verdickung der Septen kann eine hochgradige sein, so dass ihre Zahl nicht immer mit konsequenter Genauigkeit feststellbar ist. Kolumelle extrem variabel: vom Riesenwuchs bis zur feinen Lamelle in den verschiedenen Arten anzutreffen. Septenzyklus nicht ausgesprochen 3. Die Symmetrieverhältnisse sind besser entwickelt als bei den Conophyllien.

Craspedophyllia alpina LORETZ

Wir hatten sie bereits beschrieben, doch benötigt die Untersuchung dieser Karawanka-Exemplare noch folgende Ergänzung; Polytypische Art! Wand dünn; Kelchdurchmesser bis zu 15 mm. Endothek unverändert dicht, hierin keine Variabilität. Septenzahl, soweit feststellbar: 30—120. Kolumelle gross (1,8—2 mm) oder mittelgross (1,5 mm). Septen sämtlich stachelig. Verbreitung: Alpen (Österreichischer Teil); Karpaten (ČSSR); Pannonien, Nordungarn und die Jugoslavischen Alpen. Polypenkelchrand mitunter gelappt und daher der Polypenquerschnitt nicht regelmässig. Die Septen fügen sich der Kolumelle oft mit gabeligen Verzweigungen an.

Vergleichende Tabelle

Arten	Wand	Durchmesser	Septenzahl	Kolumelle	Septenordn.	Endothek
alpina	dünn	2—15	30—120	2—1,5	labil	dicht
cristata	dünn	5—6	45—50	1	labil	dicht
jablonicae	dick	4—5	26—48	1	labil	dicht
maheli	dick	7—9	82—88	Lamelle	variabel	dicht
gracilis	dünn	13—22	160	reduz.	labil	vesikulös

Von unseren Exemplaren habe ich mehrere Zeichnungen hergestellt. — Ihre geschlechtslose Vermehrung geschieht durch Zweiteilung, und inzwischen entwickelt sich ein bizentrisches Stadium (s. Abb. 22). Aussenrippung septobasal. Die grosse Kolumelle hat auch ein Strukturgefüge in Gestalt eines hufeisenförmigen Gerüstes (s. Abb. 31). Polypenlänge 11—12 mm.

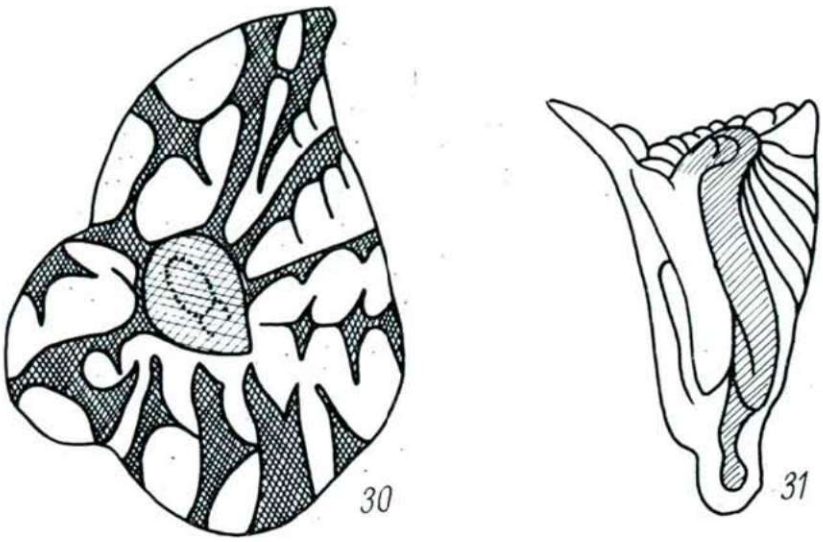

Abb. 6. *Craspedophyllia alpina Loretz*

Die Karawanken-Gesteinsproben lassen auch ander — erodierte — Korallenfunde vermuten, die ich aber wegen ihren schlechten Erhaltenheit nicht zu beschreiben wage.

Stratigraphisch gesehen sind die hier bestimmten Korallen als der ladinischen Stufe zugehörig zu betrachten, mit der Bemerkung, dass die — infolge ihrer exakten Daten und im Verhältnis zu den Typen — aus der Endphase des Ladin bzw. dem Grenzgebiet stammen, also auch der Ladin/Karnischen Stufe angehören können. Besonders von den beiden aus dem Ladin bisher unbekannten, neuen Oppelismilien ist die eine aus dem ČSSR-Ladin schon zum Vorschein gekommen.

Es sei bemerkt. dass die auffallende Ähnlichkeit der *Oppelismilia karawankana* Art mit der *Oppelismilia dedinkyensis*-Art eine Entwicklungstendenz zur oberen Trias anzeigt, wie auch aus der vergleichenden Tabelle zu ersehen ist. Die hochgradige Variabilität (Polymorphismus) der *Craspedophyllia alpina*-Art führt dahin, dass möglicherweise auch eine stratigraphische (zeitlich-dimensionale) Ursache für die Variabilität in Betracht gezogen werden kann. Es ist auch ein Überleben dieser Art in die karnische Stufe denkbar.

Demnach würde sich die folgende stratigraphische Tabelle ergeben:

Arten	Fundort	Schichten	Facies
Th. badiotica	A K P Y N—U	Ladin	Riff
Cr. alpina	A K P Y N—U	Ladin und auch oberste!	Peririff
O. karawankana	Y	Ladin/Karnisch.	Solo
O. gebhardti	K Y	Ladin	Solo
C. radiciformis	A K P Y	Ladin	Peririff
C. recondita	A K P Y	Ladin	Peririff

A Alpen (österreichischer Teil)
Y Alpen (jugoslawischer Teil)
K Karpaten (CSSR—Teil)
P Pannonien
N—U Bükk—Gebirge in Nord—Ungarn

Fasciologisch muss ferner festgestellt werden, dass die Karawanken-Gesteinproben nur eine Peririff-Facies andeuten, da die typischen riffbauenden Thecosmilien und die kolonienbauenden Conophyllien fehlen. Auch die vielen Schwämme und Hydrozoen zeigen, dass es sich nicht um einen ausgesprochen Riff handelt.

Was die Häufigkeit betrifft, sind auch die folgenden Dominanzerhältnisse in dem gefundenen Gesteinstück entscheidend, und dies mag auch auf den Charakter grösserer Gebietseinheiten hindeuten. Diesbezüglich lässt sich folgende Tabelle aufstellen:

Arten	Exemplare	Dominanz
C. radiciformis	10	dominant
Cr. alpina	9	
O. gebhardti	6	subdominant
O. karawankana	3	
C. recondita	2	influent
Anderweitige Residuen	1—1	

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